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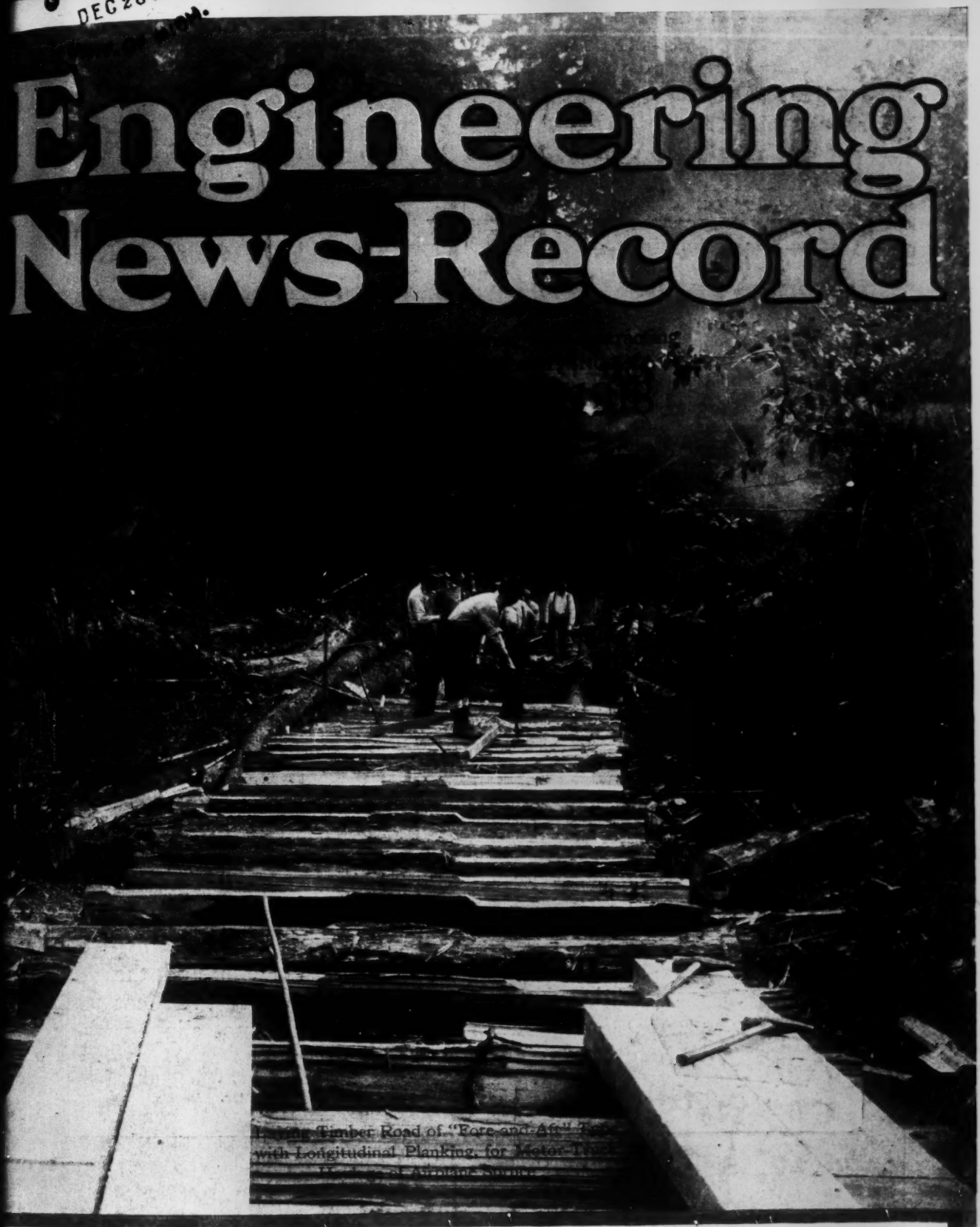
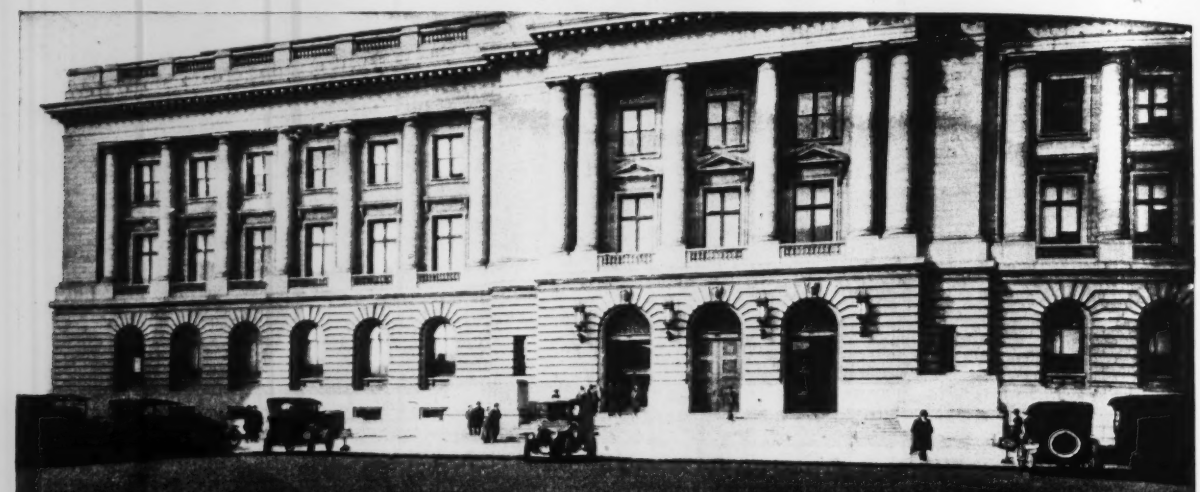
Engineering News-Record



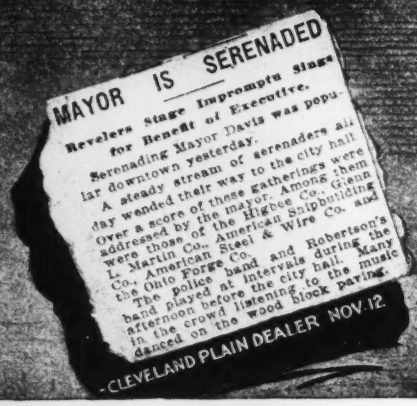
Stress Measurements on Niagara Bridges
By Charles Evan Fowler

A Study of the Failure of Calaveras Dam
By Allen Hazen

American Army Railway Shops in France
By Robert K. Tomlin, Jr.



Cleveland celebrates Nov. 11th on Kreolite Lug Wood Block pavement.



MAYOR IS SERENADED

Revelers Stage Impromptu Stage for Benefit of Executive.

Serenading Mayor Davis was popular downtown yesterday. A steady stream of serenaders all day wended their way to the city hall. Over a score of these gatherings were addressed by the mayor. Among them were those of the Higbee Co., Glenn L. Martin Co., American Shipbuilding Co., American Steel & Wire Co. and the Ohio Forge Co.

The police band and Robertson's band played at intervals during the afternoon before the city hall. Many in the crowd listening to the music danced on the wood block paving.

CLEVELAND PLAIN DEALER NOV. 12

Kreolite Lug Wood Blocks withstand the heaviest traffic, yet remain a smooth, resilient and noiseless pavement that is not slippery and will not bulge.

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A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, President

ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, Editor — CHARLES WHITING BAKER, Consulting Editor

Volume 81 — NEW YORK, THURSDAY, DECEMBER 26, 1918 — Number 26

Harvard School of Engineering Reorganized

CONGRATULATIONS for the reorganization of the Harvard Engineering School are in order. Regrets that the Gordon McKay bequest to Harvard could not be used for the Harvard-Technology merger should be forgotten now that Harvard has worked out an independent plan to meet the ruling of the Massachusetts Supreme Court. The outline of the reorganization scheme printed on p. 1198, the large and growing endowment, the Harvard spirit, the names of the faculty, all give rise to high hopes and full confidence for the success of the reorganized school.

A Leaf from the Shipbuilder's Book

BRACKET plates in ships' frames are universally flanged on their free edges. Bridge and structural practice, on the contrary, employs angle stiffeners riveted on, when the edges of gussets and knee plates call for reinforcement. The two methods are roughly equivalent. In the shipyard, flanging has been found to consume less material and less labor. It may demonstrate the same superiority in the bridge shop. Apart from any saving in production costs, flanging has a distinct value through the added proof of quality of material which it furnishes; the test of ability to bend is perhaps the most significant single test of structural steel at the engineer's command. Many steel designers and shop men engaged in ship construction during the past two years look with favor on the possibilities of flanging. If flanged work, abandoned long ago, should again be introduced in structural steel practice, the shipyard would make some return to the bridge shop for the contributions it has received from the latter.

Are There Enough Engineers?

WHETHER the demand for engineers exceeds the supply is a question generally discussed without data on which to base the argument. A little light is thrown on the subject by statistics recently compiled by the Engineering Division of the United States Employment Service, from answers to inquiries as to the number of technical men employed and needed, sent to essential as well as nonessential industries, public utilities and other organizations having technical staffs. In five Middle Western states, where the response was most satisfactory, 1453 replies were received, showing that 7931 technical men were employed and 520 were needed. The percentages of needed men over those employed were as follows: Iowa, 6%; Illinois, 6%; Indiana, 8%; Michigan, 4%; and Missouri, 1%. The inquiries were answered in October, at the peak of the demand. During this month nearly 3800 men registered with the division, and the demand for men was for about half that number. The number of registrants was slightly less during September and slightly more in November. The demands were considerably less in both months. No definite general conclusions should be drawn from these statistics, the division suggests, but they indicate that the war had not absorbed the available supply of engineers, to any extent.

Vacant Directorship in Bureau of Public Roads

THE President and the Secretary of Agriculture have the opportunity now of rendering a great service to the highway interests of the country, by appointing an engineer of vision and strength to the vacant directorship of the Bureau of Public Roads. The vacancy has come at the beginning of a new era in highway work. The bureau itself and the Secretary of Agriculture are backing a bill for the expenditure of $425,000,000 of Federal money on roads in four years, and bills for even larger expenditures will be introduced. To supervise properly these funds there should be, we believe, a National Highway Commission, but the appointment of a truly qualified director for the bureau is demanded, even though the commission should be created soon. Such an appointment would indicate to the nation that the administration appreciates the importance of the highway problem. Executive ability is an obvious qualification of the appointee, but equally important are vision commensurate with the magnitude of the problem and sympathy with modern developments in highway transportation. Lack of vision and of sympathy with new conditions have been the chief deficiencies in the bureau in the immediate past. But of one thing the President and the Secretary need to be forewarned—they cannot obtain the type of man needed for $4500, which is the very inadequate salary attached to the directorship. The position has been more than a $10,000 one in the past. It will be much bigger in the future. Government salaries are notably low, but no man adequate to the responsibilities of the place should be asked to take it for less than $10,000. Congressional action may be needed to change the compensation, but Congress will not long hesitate when the responsibilities of the work are presented, together with a list of the salaries now paid the more prominent state highway engineers of the country.

Congress Aims Blow at Fair-Compensation Contracts

CONGRESS has put itself on record against the cost-plus-sliding-scale-fee contract. In the Army appropriation bill for 1919 this form of contract is prohibited except when certificate is made by a responsible Government official that it is impracticable to employ any other form.

The need for vigorous action is plain. Unless organized contracting becomes its guardian, the fair-compensation contract, widely applied to public work as a result of the war, will fall back to its former restricted use on private work of large companies which have confidence in the contractor.

For the moment the cost-plus contract has virtually ceased to exist in Federal public works practice. Until the Congressional mind reacts to the different convictions of the building public, cost-plus contracts will not be restored. The public must be educated to the value of this contract. Note that this schooling must go beyond the engineer and the contractor, to the owner. If all contractors advocated (and all do not) the cost-plus contract, and if all engineers, instead of comparatively few, were arrayed in its support, it would not be enough. Owners must be converted to the equities of the fair-compensation contract before it will assume the position that it deserves in the construction industry. That we may not lose the gain secured by war construction, quick conversion is essential, but it cannot be accomplished through the work of a few missionaries, no matter how full of the spirit they may be, or how capable they are as exhorters. It requires concerted effort. Organized contracting must enlist as the defender of the faith.

Organized contracting—let it be said in humiliation—may claim no credit for the fact that the fair-compensation contract was written into our $1,300,000,000 worth of war construction. At the beginning of the war this construction was not under the guidance of contractors. They were the persons most vitally involved, yet they had no organization; they had no representation in the drafting of the contract for emergency construction. But now that the fair-compensation contract has demonstrated its value to the public, as well as to the construction industry, will the contractors of the country allow it to be legislated out of existence, without protest?

Here is work of public and personal benefit for the Associated General Contractors of America.

A New Era in Transportation

IN THE news that the retiring Director General of Railroads has assured Mississippi River interests that freight barge lines will be established, we read one of many accumulating items of evidence that a period of large-scale expansion and improvement of transportation machinery is ahead. War-time experiences demonstrated that meeting the requirements of this service is among the country's most urgent needs. A survey of the available facilities shows retarded development of railroads, ships, roads and waterways. There is much work to be done before this condition will be transformed.

Appreciation of the importance of well developed means of transportation is keen beyond all previous knowledge. As a people we have for some years been learning better each day how necessary is an efficient highway system. Last winter forced upon us new views of railroad capacity and limitations. More recently we have learned a great deal about ships, so that at present the creation and retention of a large merchant marine are assured for years to come. We are less ready as yet to enter with spirit and energy into waterway development, but an awakening may come at any moment. The national mind looks on the problem of transportation in a new way.

Communities that have long been blind to the existence of natural barriers at their gates now see the need of overcoming them. For example, Philadelphia is dealing in serious manner with the question of a bridge over the Delaware River. The New York-New Jersey highway tunnel project was placed before Congress as soon as the declaration of the armistice gave opportunity for considering anything other than war—and this promptness was indeed appropriate in view of the knowledge gained last year of the weakness of New York City's traffic connections. These efforts to initiate the construction of improved transportation facilities come from the same ultimate source which has put the strength of conviction into our shipping program. We have come to realize concretely that every means of transportation must be made workable and efficient.

Large responsibilities for engineers are contained in this prospect. The engineer will be called upon for new planning, based on an outlook far beyond the accustomed. The problems to be solved are those of the future, of a new era. It is likely to be a new era in transportation, as it promises to be in human relationships.

Agreement Among Engineering Societies on Broadening Scope

ALL four of the great national engineering societies now have committees at work studying the organization of these societies and considering various proposals for changes. An extended discussion took place at the annual meeting of the American Society of Mechanical Engineers recently, when its committee on this matter presented a preliminary statement. At the same session addresses were made by Prof. A. N. Talbot, president of the American Society of Civil Engineers, and Prof. Comfort A. Adams, president of the American Institute of Electrical Engineers, reviewing the work under way in these two societies.

It is already evident that there are a number of diverse subjects with which these committees will have to deal. Probably the underlying idea back of the entire movement is best expressed in a resolution adopted by the mechanical engineers' committee. The purport of this resolution is that the engineer has been in the past too closely limited to the purely technical side of his work, and that the scope of engineering societies should be widened to aid their members to prepare themselves for and undertake broader responsibilities. There has been in the past, however, and still exists in all the societies, a conservative opposition to papers and discussions which deal with economics and sociology or with matters of legislation or Governmental affairs.

This barrier is, of course, being rapidly broken down, as is witnessed by the prominence given to "human engineering," including the relations of labor and capital, in the papers at the mechanical engineers' meeting recently, and the papers which have been presented before the civil engineers on valuation and ratemaking. Such of these barriers as still remain in the constitutions or practice of the various societies are pretty certain to be swept away soon. Engineers have come to realize that a grasp of such matters is essential to the individual engineer if he is to render the larger service toward which his ambitions tend.

There is, in the second place, a very general demand in all branches of the profession, as evidenced at the recent meeting, that activities in these directions shall not be confined to mere presentation and discussion of papers, but that engineering organizations shall take an active part in public affairs, not merely in matters where the welfare of the profession is concerned, but in those where the engineer needs to guide and direct public opinion and public policy on questions of which the engineer is the most competent judge. To some extent the engineer *is* being recognized. A very considerable proportion of the men who had the chief responsibility in carrying out the great war program were engineers. With the reëstablishment of peace, however, the tendency is very strong in all matters under Government control to put the politician in places of chief responsibility and relegate engineers to purely technical work. One of the problems before the profession is to devise methods by which it can make its influence felt, so that engineers who have the necessary personal as well as technical qualifications will be selected for public positions where technical and executive ability are requisite for the efficient conduct of work.

A National Problem: How to Maintain Production

ONE of the after-the-war problems which appeals most directly to engineers, although it directly concerns everyone, is the problem of employment; employment for millions of soldiers mustered out of service, employment for the vast factories and machinery equipment which are turning out war material, and for the huge army of men and women who are working in them.

The war, with all its terrible total of deaths and suffering and destruction, has had some compensations. It has taught the world some new lessons in economics. It has demonstrated the wonderful possibilities of production by modern methods when all the energies of a nation are actively employed.

For more than four years a large part of the working forces in all the civilized nations has been diverted from the ordinary occupations and directed to the work of killing and destruction. No one would have believed, in advance of the actual demonstration, that it would have been possible to keep the world's population fed and clothed and housed—inadequately, it is true, but in some sort of fashion—and turn such a large percentage of the workers and the factories into the job of waging war and making war supplies.

Suppose now that the war is won and the problems of reconstruction face us we are able to find a way to maintain productive activity, not at its war-time rate indeed, with its necessarily heavy sacrifices, but at a rate that shall keep fully employed all the available labor and productive machinery. If we can do this, then that part of the loss and destruction of the war which admits of repair can be made good in a time that would have seemed incredibly brief to one who knew only the pre-war rate of production.

The war-time excess of demand over supply, which caused prices to mount by leaps and bounds, will not end because the war ends. The world has used up its surplus stock of food and fuel and clothing and machinery. But the price paid for the supplies to be used in making good the war's waste will be no longer of secondary importance. The burden of taxation will bear heavily on all productive industry for many years to come. If production is to be maintained, therefore, the work must be done economically and efficiently and at only a moderate margin of profit.

Continuous production at full capacity enables the manufacturer to run on a small margin of profit over direct labor and material cost. The workman who has a steady job the year round can prosper on a lower wage rate than the one who is employed on a part-time basis. Hence, if full speed in production can be kept up, the cost of the product can be reduced below what will be possible if we drop back to pre-war conditions.

Let us at all costs not lose sight of the foundation fact that the more goods there are produced the more there will be for all to share. Under the pre-war conditions it was supposed that the world was suffering from overproducton. We know now—unless the lessons of the war have been already forgotten—that it was not overproduction but underconsumption. At least nine-tenths of the population of civilized lands always wants more than it can buy. There may indeed be overproduction in individual industries; but to say that overproduction exists in all industries is equivalent to saying that men and women have all they desire, and that is contrary to human nature.

It ought to be plain enough now that the carefully reared structures by which in each industry before the war the capital and the labor were each strenuously endeavoring to see how big a price they could maintain for the product, were all contributing to the general injury of the whole. Had that limitation of production continued to hamper industry, the war would have been lost. If that artificial enhancement of prices and consequent limitation of production is reëstablished, we shall be no longer a united nation, economically speaking, but a conglomeration of industrial factions, each seeking to benefit itself at the expense of all its fellows.

It will take a long time to transform the work of munition production; and a longer time to fill the needs of the world impoverished by the four years' struggle. It is necessary to look beyond that time, however, to a time when sympathy with the cripple and interest in the returned soldier will not be at the high pitch it is today. It is, then, under the normal conditions of peace, that we must find a way to keep the wheels of industry running at full speed, so that the world as a whole may be made even richer in material things than it was before the war.

A Study of the Slip in the Calaveras Dam

Based On a Survey, Borings and Pile Drivings—Consideration of Materials Used for Steam-Shovel and Sluiced Fill—Reconstruction Plans

By Allen Hazen
Consulting Engineer, New York City

A DESCRIPTION of the slip in the Calaveras Dam, by Leonard Metcalf and the writer, appeared in *Engineering News-Record*, of Apr. 4, 1918, p. 679. This was written immediately after the slip and summarized the information then available in regard to it. Since that time an accurate survey of the slip has been made. Thirty test borings and 85 test piles have been driven, and the situation has been studied by the engineers of the Spring Valley Water Co. The following is presented as a supplementary statement.

Materials Used in Construction

The first material placed in the dam when construction was begun four years ago, extending to El. 630, was sluiced gravel from the floor of the valley above the dam. Over a large flat place in the upper central part of the dam this material was from 40 to 50 ft. thick.

The largest stones in the gravel were excluded by screens. Everything that could pass the pumps—that is, stones up to 4 to 6 in. in diameter—went into the dam. The finest part of the gravel was sand. The particles of this gravel and sand were all hard and permanent. Their specific gravity averaged about 2.70. The soil of the valley above the gravel was sluiced with it, but, generally speaking, there was no clay in it and no considerable amount of very fine particles. Without attempt to describe them with precision, it may be said there were but few particles less than 0.10 mm. in diameter. The few that were smaller came mainly from the soil.

This gravel all settled solidly to place in the dam, drained promptly and formed hard, solid embankment. It is now covered by the remaining parts of the dam, and it is possible only to reach it by borings. There are limitations to the information that can be obtained from boring samples and it has not been possible to examine the gravel in place as fully as the more accessible material. With exceptions, to be mentioned, there is no reason to think that any part of this gravel was moved during, or took part in, the slip.

The remaining higher parts of the dam were composed of steam-shovel fill and sluiced material from the adjacent hillsides. The steam-shovel fill was mainly a soft sandstone rock. It is hardly a true sandstone, for the particles of sand in it are not siliceous. On continued exposure it breaks up largely, forming a material that is almost as fine in grain size as clay. Its specific gravity varies from 2.0 to 2.6, averaging about 2.3.

As the solid particles composing the sandstone have an average specific gravity of about 2.65, it follows that there must be from 5 to 23% of voids in the sandstone as it comes from the quarry. A specific gravity of 2.3 indicates 13% of voids. These original voids remain in the unbroken pieces of rock in the dam. In addition, there are the voids between the pieces. The porosity and the lightness of the rock explain why the material cannot be compacted to as great a weight per cubic foot as some others.

The cementing material of the sandstone seems to be in part calcium carbonate and in part calcium sulphate. Of these, calcium sulphate is more soluble in water, and to this may be attributed the fact that the sandstone is very much stronger when it is dry than when it is wet.

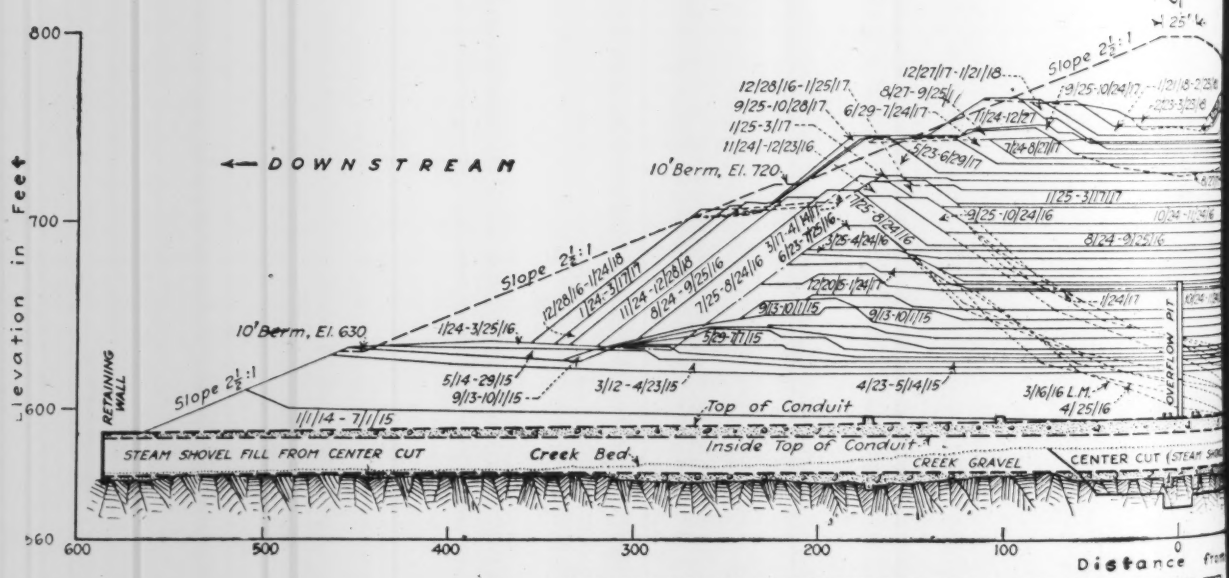


FIG. 1. PROGRESS OF CONSTRUCTION OF THE CALAVERAS DAM UNTIL THE

When first thrown out by blasting, large masses of the sandstone seem firm and hard, but upon exposure to the weather a great part of it disintegrates, some of it rapidly and some slowly, until the hardest rocks are reduced to piles of clay—either powder or mud, according to the season.

The Steam-Shovel Fill Not Rolled

The steam-shovel fill was dumped from cars and wagons into the dam. It was not rolled. As first dumped, it was comparatively loose. Where there was teaming over it, compaction took place at the top of each layer, but not so much elsewhere. The result of this incidental rolling is well shown in some of the remaining sections of the dam, where there is a harder layer 6 or 8 in. thick at intervals of 4 or 5 ft., representing the tops of the successive layers. Under heavy pressure, as the weight above the material was increased, it settled, and in the lower parts of the dam, where it is now exposed, a considerable degree of solidity has been attained.

The parts of the steam-shovel fill that have been under greatest pressure now weigh about 110 lb. per cubic foot, dry. With the moisture normally carried the weight is about 120 lb. per cubic foot. When so compacted the material has about 34% of voids; this includes the voids in the unbroken pieces of rock. Nearer the surface and under less weight the material is lighter and the percentage of voids is greater.

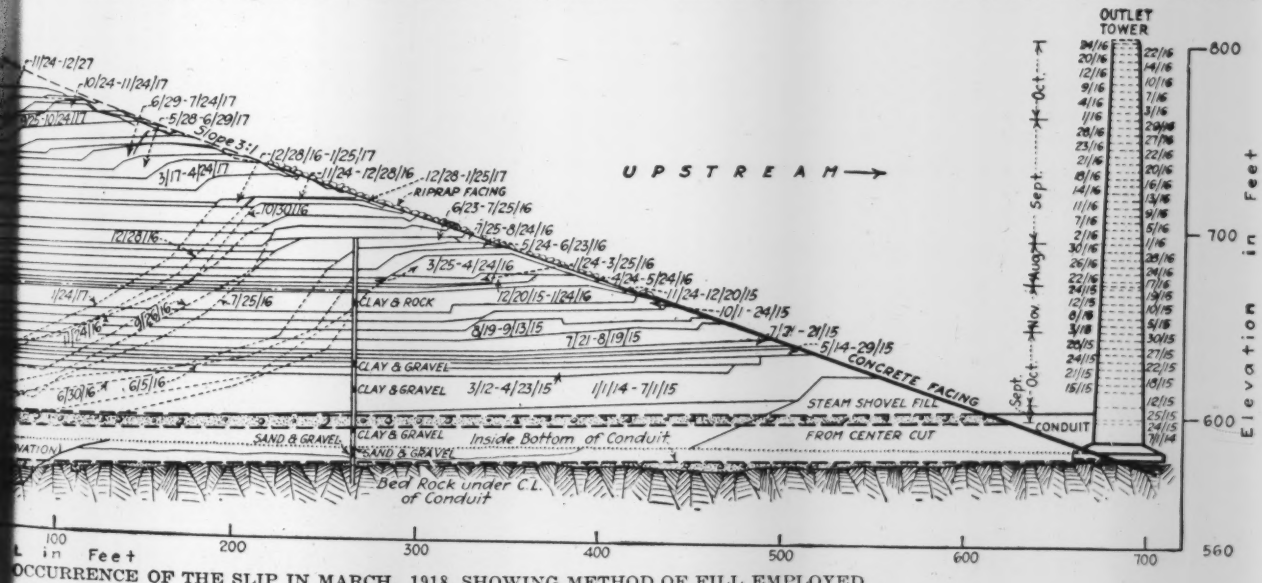
The sluiced material above El. 630 was obtained from the surrounding hills. In general, the soft material above the harder rocks was taken for sluicing; it contained both the surface soil and the disintegrated soft rock. Some of the rock in the neighborhood was serpentine, but serpentine was recognized as an undesirable material for dam building, and it was avoided in the sluicing operations. Small masses of it here and there were sluiced because it was inconvenient to exclude them, but, generally speaking, no serpentine or decomposed serpentine was placed in the dam. The little that went in played no part in the slip.

The rock forming the base of the sluiced material included the soft sandstone and shales. The shales differed from the sandstone principally in being softer. There were also other shales, darker in color and having no resemblance to the sandstone formation. There was also a certain amount of diatomaceous earth which occurred at one place north of the dam.

All of this material went through centrifugal pumps and through long lines of pipe at high velocities. The harder particles were worn by this treatment until they were almost spherical in shape. They looked like particles of creek gravel but could be easily distinguished from them because they were completely broken by a gentle tap of the hammer. These large particles were deposited in the toes of the dam, and the spaces between them were partially filled with clay. The material so produced was similar to the steam-shovel fill in weight and stability. The softer particles were pulverized, and the proportion of fine material resulting from the treatment was large.

Steam-Shovel Fill and Sluiced Material

In general, the amounts of steam-shovel fill and of sluiced material above El. 630 were about equal, but as some of the sluiced material was hard the proportion of soft clay was very much less than half of the volume of the dam. The method of placing generally followed was to put the steam-shovel fill on the tops of the two toes, upstream and downstream from the central pool. The sluiced material was placed between. The pool in which the sluiced material was deposited was often of considerable width. The steam-shovel fill and the hard parts of the sluiced fill were always encroaching upon this pool and narrowing it. As the dam grew higher the proportion of steam-shovel fill increased. The material deposited along the edges of the pool rested on the soft, sluiced material underneath. The steam-shovel fill was heavier per cubic foot than the soft, sluiced material, and to a large extent, when placed upon it, the former must have broken off and settled down through the softer and lighter mass and into the deeper and heavier and more solid portions of the sluiced material. The remains of this material in the interior of the dam,



OCCURRENCE OF THE SLIP IN MARCH, 1918, SHOWING METHOD OF FILL EMPLOYED

as disclosed by borings, give some idea of what happened. The whole lower part of the interior of the dam is made up of masses of steam-shovel fill lying between and partially separated by the sluiced clay into which it had fallen and by which it was surrounded.

Finest Sluiced Material Near Center of Dam

This sluiced material was naturally finest in grain size near the middle of the dam, but there was a considerable width through which no appreciable variation has been noticed. Outside of this there are more large particles, and the material is in general more pervious.

Chemical and physical analyses of samples of the sluiced clay have been made, and they give a fair idea of its composition. Corresponding data for the original rock and for creek gravel are given for comparison.

CHEMICAL COMPOSITION OF MATERIAL

	Clay Core Sluiced	Steam-shovel Fill Soft Sandstone	Creek Gravel
Silica, SiO_2	57.7	60.0	57.0
Alumina, Al_2O_3	17.9	9.7	12.5
Iron, Fe_2O_3	7.3	15.5	13.7
Lime, CaO	1.7	4.2	5.2
Magnesia, Mgo	3.6	3.9	4.2
Specific gravity of solid particles	2.65	2.65	2.70

In general, about one-half, or little less than one-half, of the clay core is ferruginous clay, with particles very small in size, down to 0.002 mm. in diameter. The remainder of the material consists of larger particles, up to 0.02 mm., of minerals like the rocks in the neighborhood of the dam site. These consist mainly of silicates of iron, aluminum, etc. There are but little lime and magnesia in them. All of the core material is very small in grain size, ranging from 0.002 to 0.02 mm.

There is a striking scarcity of grains of middle size in the material that results from the application of the hydraulic process to the soft sandstone rock and to the soil above it. This scarcity amounts to an almost complete absence of particles through a wide range of sizes. The clay core is composed almost entirely of particles less than 0.02 mm. in diameter. The coarse part, consisting of rounded masses of rock hard enough to withstand the agitation of the sluicing operations, is mainly 10 mm. in diameter and over. No considerable quantity of particles of intermediate sizes, between 0.02 and 10 mm., can be found in any part of the sluiced material above the gravel. The gravel from the valley floor was mainly composed of particles within this range, and the range was completely filled out within the limit, so that there were no breaks in the series of grain sizes.

Of Possible Fundamental Importance

This difference may be of fundamental importance. The way in which a soft rock breaks up may determine whether or not a substantial sluiced dam can be made from it. Our present evidence is that soft rock that breaks at once to clay without producing sand and gravel is not desirable sluicing material. If this proves to be the fact, the objection to sluicing such soft rocks will not extend to other materials, and the conditions found in the Calaveras dam will have no bearing in considering the probable behavior of materials that have the full range of particle sizes.

The large mass of fine-grained material went slowly down into the water in the central pool in the dam. It soon reached a condition where the remaining voids almost prevented the further escape of water. Material composed mainly of particles less than 0.01 mm. in diameter does not settle rapidly in water, nor does it allow water to pass through it when it is settled. The excess of water in it, if it escaped, had to do so either by horizontal drainage through the toes or else by a process of exclusion from the settling of the solid matter while the water rose vertically upward through it.

The material was so fine in grain size that the horizontal movement of water through it became inappreciable. There were hundreds of feet of it, in horizontal extent, in the bottom of the dam, and no one knows how many years would have been required for the surplus water to have worked out by seepage. In the same way, the material was so fine-grained and the mass was so little heavier than water that the settling of the mass through its own excess of water was extremely slow. The sluiced material in the middle of the dam remained at the time of the slip with so large a percentage of voids that it could not be anything but an unstable semi-liquid.

Sluiced Material with 40 Per Cent. Voids Seems Stable

Tests have been made of the sluiced material that flowed from the dam and of that which remained in the dam. Generally speaking, it may be said that the upper part of the material that flowed contained about 65% of voids or of water by volume. The least compacted material remaining in position in the dam after the slip contained from 45% to 50% of voids. One cannot set precise limits, but so far as the evidence goes sluiced materials that contained 40% of voids, or less, were stable. Between 40% and 50%, the material is open to question. It was not sufficiently solid so that one could have confidence in it, but it was solid enough to have resisted flowing, in many cases. The material that flowed was that which contained 50% and upward of voids.

In comparison with this, the behavior of soft clay, as it dried out in the air, is interesting. In drying, a crust was formed over the top clay standing in pools after the slip. This increased rapidly in thickness and was soon cut by deep cracks. In the course of three or four months the level of the pool of clay remaining near the center of the dam had dropped almost two feet. The drop is believed to be due entirely to the compacting of the material, resulting from evaporation.

Samples of this air-dried material from the top have been cut out and examined. They contain on an average about 35% of voids. When dry there are 65% of solids in it, instead of the 35% in the original material. One cubic yard of clay, measured as it flowed, has been reduced in volume by evaporation to 0.54 cu.yd. If it could have been so compressed in the dam it would have made the hardest and strongest kind of embankment, only a little less resistant than the soft sandstone rock in its original position in the hills.

A section through the dam showing the order in which the materials were placed, giving an idea of the method of placing the steam-shovel fill, and showing the

progress of the work up to Mar. 24, is illustrated in Fig. 1. Fig. 2 is a map of the dam after the slip. The letters on it refer to the various parts of the dam.

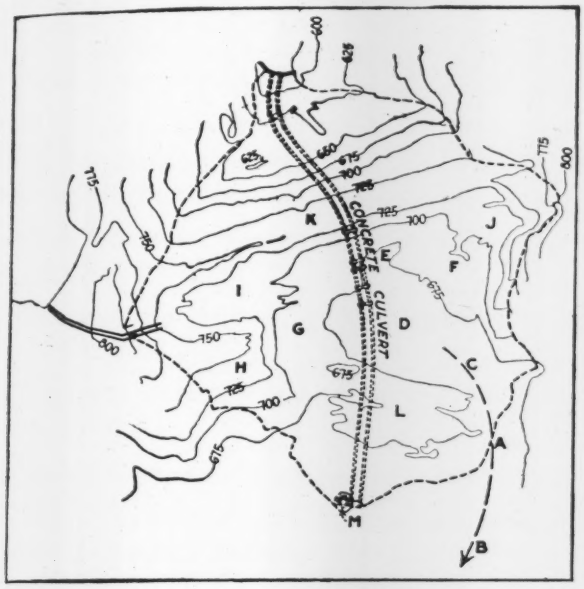


FIG. 2. TOPOGRAPHIC MAP OF CALAVERAS DAM IN APRIL, 1918, AFTER SLIP

Fig. 3 shows a developed section of the dam before and after the slip.

The upper toe of the steam-shovel fill had moved forward 300 ft. or more and had dropped in elevation perhaps 80 or 100 ft. on an average. It has also turned approximately 30° horizontally, in moving. It seems certain that there must have been under a large part of this upper toe some clay that acted as a lubricant, but, if so, it was broken up or dissipated or pushed out in the process of slipping, for the numerous borings through this part of the dam have given no indication of any considerable mass of clay. It may be pointed out, however, that a mass of clay sufficient, when wet and under pressure, to act as a lubricant would quickly become dried out and absorbed between masses of steam-shovel fill, and it would not be surprising if no trace of it could be found afterward in samples taken from borings. It has been found by boring that there is pervious gravel connected with the lake under the whole of this slipped mass. Water enters freely in the lower part of each well and stands thereafter exactly at lake level.

The sluiced clay, which was mainly in the central part of the dam, flowed out in great part through a narrow channel, following approximately the line C A B. This material came out as a cataract that was observed by those who saw the slip when the dam first opened. It must have scoured a path through the underlying sluiced gravel, to the bottom of the valley. The material flowed out rapidly, and until the level of that which remained in what we have since called the pool, at C and D, was only 5 ft. above lake level at the lowest and most fluid point. When the flow slowed up parts of the solid upper toe, L, broke off and fell across this outlet channel. This happened principally at two places, marked A and B. The material so broken off formed dams across the channel. There is a lower pool between A and B and an upper pool at C which is deeper than the lower one. The pool C contains only soft clay to the very bottom. In the upper part, of the pool, however, at D, the sluiced gravel remains at the bottom, and above it are masses of steam-shovel fill that have settled into and are surrounded by clay.

Of the total depth of 80 ft. of material now remaining at D, 55 ft. is made up of material so hard that a 2400-lb. hammer dropping 25 ft. caused only 0.3 ft. penetration of a pile. Only the upper 25 ft. are of softer material that is not stiff enough for use in reconstructing the dam.

One part of the upper toe, at H, remained in position. As the ground on which it stood was higher, the embankment there was not as high as elsewhere, and the lubricating clay layer may not have reached under it. After the main slip had taken place this remaining mass, at H, must have been larger than it now is, and there was also a corresponding but smaller portion of the dam at the eastern end. These must have been left with high vertical faces which were incapable of standing, and directly afterward masses of these broke off and moved longitudinally toward the center, at G and F.

At K the remaining downstream toe stands to a height of 160 ft. above the valley floor and 70 ft. above the interior of the dam. This also must have stood after the first slip to a height that was not stable, and the higher portions of it broke off and slipped into the center of the dam.

Along the line of the center of the old dam, at I, E and J, there remains the hardest part of the remaining sluiced-clay core. Through this are interspersed masses of steam-shovel fill, and over it are other masses of loose steam-shovel fill that broke off after the main slip and came down from the lower toe. This part of the dam has been penetrated by the greatest number of test wells. Each of these wells has its own water level, but that level is always higher than lake level, and 100 ft.

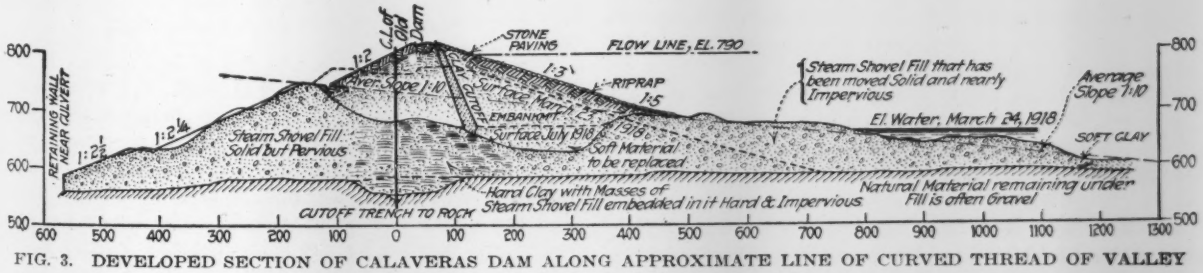

800
700
600
500
RETAINING WALL NEAR CULVERT
1:2
1:2¼
1:2½
Steam Shovel Fill Solid but Pervious
Old Dam
STONE PAVING
FLOW LINE, EL. 790
1:3
RIPRAP
1:5
EMBANKMENT
Surface July 1918
Surface March 1918
Soft Material to be replaced
Steam Shovel Fill that has been moved Solid and nearly Impervious
Average Slope 1:10
El. Water, March 24, 1918
SOFT CLAY
Hard Clay with Masses of Steam Shovel Fill embedded in it Hard & Impervious
Natural Material remaining under Fill is often Gravel
CUTOFF TRENCH TO ROCK
600 500 400 300 200 100 0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300

FIG. 3. DEVELOPED SECTION OF CALAVERAS DAM ALONG APPROXIMATE LINE OF CURVED THREAD OF VALLEY

Showing surface before and after the slip and the proposed outline for reconstruction

or more above the water below the dam. The fact that these water levels are retained even after months of exposure to evaporation under a hot sun, and with no rain, is the best and fully sufficient evidence of the substantial tightness of everything below. There is no need of taking a new cut-off trench deeper than is needed to pass the loose rock fill that has fallen down from the sides since the main slip occurred.

Coefficient of Friction of the Moving Material

An effort has been made to find the coefficient of friction of the moving material. Some of the conditions are known with definiteness, others with less certainty. Assumptions must be made, and the calculation at best will be open to some uncertainty. Nevertheless, it may be helpful, in discussing conditions of stability in reconstructing the dam, and may be of general interest.

On Mar. 24, before the slip, the pool in the center of the dam was 124.5 ft. above El. 630, which is taken as the top of the sluiced gravel and which is not brought into the calculation. The average weight of the sluiced material in this depth, as disclosed by tests of material that flowed and of material that remained, was about 100 lb. per cubic foot. The material was so fluid that it may be assumed that the whole of the weight is represented by horizontal pressure. The horizontal thrust per lineal foot computed from these data is 775,000 lb., or 387 tons.

In comparison with this, the solid material in the toe had a section of 32,000 sq.ft. and an average wet weight of about 120 lb. per cubic foot. The total weight per running foot is 3,840,000 lb. or 1920 tons. This weight is known with comparative definiteness from the sections and from the tests of material.

From these figures, the coefficient of friction for the whole mass at the start of the slip may be computed as 0.20. This may be taken quite definitely as the coefficient of friction of the whole lower toe as it existed Mar. 24.

Uncertainties as to Underlying Clay Layers

We now come to the uncertainties. How much of this upper toe was supported by clay layers that were under pressure due to the head of the material in the pool, and how far these clay layers lubricated, and perhaps encouraged, the movement of material over them, is not known and cannot be known. There is no doubt that such underlying clay layers played a part, and very likely an important part, in the movement, but it cannot be told how large it was and what coefficient of friction may be counted on for embankment that is not so lubricated.

It is interesting to note that a similar calculation made for the conditions of June 18, 1917, when the first slight movement of the upper toe was observed, and when the dam was considerably lower, indicates a coefficient of 0.175. This is not a coefficient of friction, because the pressure was not sufficient at that time to make the dam flow. But it does indicate a pressure that sufficed to produce a slight initial movement, sufficient to attract attention.

It is also to be noted that the front upper part of the dam, to the very bottom, moved forward in the slip. The concrete base at the bottom of the paving is found at the very front of the slipped material, 370 ft. from its original position, and is easily identified. This would seem to indicate that the sluiced gravel below El. 630 also slipped. On the other hand, the great solidity of the material farther up, which was able to resist the test piles, seems conclusive evidence that the slip did not extend to the lower layers where the piles were driven. If it had so extended, that space would now be occupied by the softer material that was in the heart of the dam.

As to the Progress of the Flow

The men who saw the dam go state that at first the whole mass seemed to move forward as a unit. Afterward it seemed to separate, and the parts that were farthest back stopped, while those that were further advanced continued to move forward. This method of movement is shown by the conditions of the remaining material. It is not evenly distributed, but is broken up into a series of ridges separated by valleys. Three main ranges of ridges are noted. Each of them is split into a number of secondary ones. The whole topography of the slipped dam reminds one of a miniature raised map of the surrounding mountains. If this upper toe had been moved over solid underlying material, it does not seem possible that this breaking up and progressive movement of parts of it would have taken place.

The observers' story and the topography of the remaining material suggest that the material was carried forward on a good lubricant, and that the lubricant first became used up or expelled near the center of the dam and left the higher parts of the dam on solid bottom while there was still lubricant to carry forward the lower and more advanced portions. Certainly, it would not be surprising if there had been a considerable dissipation and absorption of the sluiced clay during this process.

Looking at it afterward from the standpoint of the examination of the material by borings and otherwise, it is surprising to find what a large proportion of the whole mass of moved material is hard and solid and apparently entirely outside the range of materials that would flow. And it is also hard to find enough soft clay anywhere about this work to account for what happened.

It is also demonstrated, by a little work of reconstruction that has been done, that a mixture of soft sluiced clay and steam-shovel fill is quite as hard as, perhaps even harder than, the steam-shovel fill without the clay. In other words, in the Calaveras dam there were all the elements of a thoroughly sound construction. Only the method of combination was not such as to produce a stable result.

Outlet Tower Broke and Fell

The outlet tower broke and fell in two parts. It was built of concrete rings, each 4 ft. high, and was heavily reinforced. Thirteen of the joints between the rings opened. One broke entirely off, while 12 remain, with ½- to ¾-in. cracks. The two parts of the tower were moved forward, the lower one, 88 ft. long, about 370 ft., and the upper one about 445 ft. The lower one was apparently pushed by the solid material behind it and slid along on the ground ahead of the flowing earth.

The lower part of the tower shows well marked scratches, which were made no doubt by the passing rock on the lower 30 ft. of it while it still stood. Otherwise, the concrete of the tower is undamaged.

The slip left about 3,000,000,000 gal. of water above the dam. The outlet conduit was left undamaged, but it was partly filled with mud and débris, and there was some seepage into it. The conduit was not a pleasant place to go into at first, and it was some time before the actual conditions were ascertained. But after the material in it had somewhat dried out, and the seepage did not increase, it was possible to explore the conduit to its upper end, and it was then found to be undamaged. Even the gates at its entrance were undisturbed.

The outlet tower had been built on an independent foundation at one side. The connection passage was 7 ft. square. Through this connection there had evidently been a flow of loose material, fluxed with water, for a few moments, until it became choked. It was this material which partially filled the conduit with débris.

To insure the remainder of the dam against destruction and to permit arrangements for reconstruction, it was necessary to get rid of the water above the dam, and to make provisions for passing the flows that must be expected during the reconstruction period. The end of the old culvert was covered by 60 ft. of débris, and the water line in the lake was slightly above this point. There might be rains that would raise the water level considerably before any work then started could be completed.

New Outlet Tunnel Built for Drainage

Three lines of protective work were decided upon, and have since been carried out. The first of these is an 8-ft. tunnel 1475 ft. long driven through rock outside the dam at a level to give complete drainage. This tunnel was broken through Oct. 4 and the reservoir began to drain through it on that date. Now that the water is out of the reservoir, the tunnel is being extended to a point selected for the intake. Gates have been set to control the flow and to permit 4,000,000,000 gal. to be stored during the coming season.

This tunnel is capable of carrying 1500 sec.-ft. The drainage area above the dam is 100 sq.mil., and is quite mountainous. Local data covering several years indicate a maximum flood of 10,000 sec.-ft., but it is recognized that a much larger flood is possible. The tunnel will not carry the largest flood flows as they come, but it will carry the largest average flow that is to be expected for any considerable number of days. It was not advisable to make the tunnel large enough to carry extreme floods. A certain amount of storage behind the dam can be utilized to help control them. But before doing this it was thought wise to strengthen the remaining parts of the dam.

The slip had left a depression at a point marked E, Fig. 2, where rising water in the reservoir might come against the loose steam-shovel fill of the lower toe and percolate through it in quantities sufficient to do damage. Accordingly, after borings had been made and an outline plan for reconstruction had been prepared, an embankment was started at this point as the second protective measure. This rolled-fill embankment has now been completed to El. 710. It will form a part of the permanent reconstruction. At this elevation 15,000,000,000 gal., or more than 8 in., of run-off from the tributary area may be held. In connection with this storage the 8-ft. outlet tunnel has sufficient capacity to handle any flood that may be anticipated, but the inlet to it will be far under water during a heavy flood and not accessible in case of accidental stoppage. The embankment as placed is believed to be almost water-tight, but in the reconstruction a new cut-off wall will be placed upstream from it.

As an additional precaution, and as the third protective measure, an open caisson has been sunk on the site of the old tower, connecting with the outlet tunnel at the bottom. This will furnish an outlet for an additional 1500 sec.-ft. with a point of entrance 60 ft. higher than the entrance to the tunnel.

Reconstruction of the Dam

I shall take this subject up very briefly at the present time. Professor W. H. Burr of New York City, and William Mulholland, of Los Angeles, have advised in a preliminary way in regard to it, and Professor Charles Derleth, Jr., of Berkeley, has made a detailed study of the materials and their stability.

The site for a reservoir is an excellent one. The materials of construction are sound, within their limitations. The dam as projected is none too large to develop the capacity of a magnificent catchment area. It can be and it must be rebuilt to the full intended height.

The elements of weakness in the old dam were mainly removed by the slip. Such parts of them as still remain in the softest parts of the sluiced material must be replaced by harder materials in the reconstruction. This does not mean necessarily that the soft material must be entirely removed, for when it is mixed with the soft sandstone, rock or other material it combines with it to form a mass well fitted for dam construction. It is only when it is by itself in two large masses and with an excess of water that it is dangerous.

The remaining lower toe of the dam is sound. The upper toe of the dam that slipped has come to a solid bearing in its new position. It will not ever slip again. It is not as highly compacted as it might be, and when further weight is put upon it some settlement is to be anticipated. But the bulk of the 1,400,000 cu.yd. of new material that will be required to finish the dam will come between those remaining parts of the old dam, and will not rest upon them, but upon the remaining material in the heart of the old structure. The materials remaining in the central part of the dam, ranging in depth generally from 60 to 100 ft., have been tested by borings, by driving piles into them, and by samples. They have also been tested by the embankment that has been placed since the slip, arranged to produce a heavy unbalanced load on the material underneath. In other words, the reconstruction so far carried out has been arranged to test the bearing capacity of the remaining materials that are to be utilized, and it appears possible and desirable to continue this policy throughout the whole reconstruction.

The rebuilt dam will have a larger section than the old one. The slopes will be flatter, especially near the bottom, where the great mass of slipped material will form part of the new dam. It would not be safe to count

upon this material on slopes as steep as might be used for material that was carefully selected and placed, but at the slopes which exist, averaging about 1 to 10, there is no possibility of its moving. A new cut-off will be established, not always in the center of the old dam, but at convenient points, usually upstream from it, where impervious material can be most easily reached. The reconstructed dam will be curved in plan, not because there is any merit in the curve, but because the curve permits better use to be made of the remaining materials.

The dam may be reconstructed of material placed dry with rolling. Materials are available for this, and there can be no question as to sufficiency of the process. As an alternative method, gravel like that used in the lower part of the dam may be used, with sluicing. If the whole dam had been constructed of this gravel there would have been no slip, but the best of the gravel is now at the bottom of the reservoir. It will be desirable, and it will be possible, to use the reservoir for storage of needed water to a limited extent, but this use will keep the best gravel covered by water. Handling it by dredges is a possibility, but it is not now apparent that it can be so handled at a material saving as compared with dry fill. It may be possible to use in reconstruction a deposit of schist on the east side of the valley. None of this material was used in the original construction, but it is near the dam and seems to have certain points of advantage over other local materials.

Sluicing soft materials that produce by their breaking down an excess of particles less than 0.01 mm. in diameter, and which may be classed as clay, will not be done again.

The valley of Calaveras Creek at the dam is very crooked. It is so crooked, in fact, that no section on a straight line gives an adequate idea of what happened in the slip. To show better what happened a developed section of the dam along an irregular line following approximately the thread of the valley is shown as Fig. 3. This section illustrates the dam as it was before the slip, the position of the material after the slip and the proposed section of the reconstructed dam. It is interesting to note that the slipped materials came to rest finally upon a general average slope that was only about 1 in 10, but nearly all of the material that slipped is entirely stable by itself on a slope of 1 on 2, and even on a slope that is considerably steeper than that.

Motor Trucks and Plank Roads Help to Get Out Airplane Spruce

Heavily loaded motor trucks have been operated over unstable soils and through mountainous country, in bringing out airplane spruce from thinly scattered stands on the north Pacific coast. The seeming impossibility of this feat, under the natural conditions prevailing, was overcome by the construction of specially designed plank roads. High truck efficiency and low truck maintenance, despite the heavy grades and overloads, are reported.—Editor.

Plank Roads Help to Solve Spruce Production Problems

PLANK roads constructed at moderate cost made it feasible to get motor trucks into many of the thinly scattered stands of spruce along the north Pacific coast, and without the motor truck or some other form of mobile and quick transportation spruce from these forests could not have been brought out at the rate required by the Government's Spruce Production Division. Thus, plank roads suddenly became of greater importance, perhaps, than ever before, and various improvements in design and construction were developed. It is notable that, contrary to the usual practice on temporary roads, accurate location surveys with transit were made under the direction of an engineer. This has been particularly worth while, because of its effect in decreasing first cost and maintenance of the planked surface. A great decrease in tire wear on plank roads, as compared with gravel surfaces, is also reported.

Two types of constr ction are used on these roads. In one the planks are placed crosswise, while the other calls for longitudinal planking and is known as the "fore-and-aft" type. For the former type 8-ft. plank were used at first, supported on stringers placed under the lines that the wheel treads would follow. This did not allow much margin of safety, so 10-ft. planking was tried. On this wider roadbed, however, the drivers did not keep over the stringers, and this greatly increased the cost of maintaining the roads. To overcome this the standard width was again placed at 8 ft. for tangents and the "fore-and-aft" design was improved and used on all grades less than 4%. Where grades are steeper cross planking is considered necessary, to avoid slipping in wet weather.

For cross planking, the stringers are made of poles

CROSS PLANK ROAD ON SHARP, BLIND TURN AND ON 17 PER CENT. GRADE

not less than 10 in. in diameter. They are laid in pairs and close together on each side of the road, so that there is no overhang of plank. The roadbed is graded so as to give the stringers a firm foundation. Where curves are sharper than 20 deg., the plank are cut 10 ft. long and two additional stringers are provided. For ordinary traffic 3-in. planking has been found to give good service, but, in the few cases where chains are used on grades, a 4-in. thickness is recommended because of the heavy wear. A road of this type around a sharp turn is shown in an illustration. Where the "fore-and-aft" construction is used, sleepers at least 12 in. wide and 6 in. thick are laid first. These are 10 and 12 ft. long and are placed on 4-ft. centers. Split cedar has been found to be about the best wood for this purpose. On these sleepers, two 4 x 12-in. planks are laid on each side for wheel treads, the outside width being 7½ ft. This has been found the best width for all vehicles from Fords to 5-ton trucks.

COMPLETED "FORE-AND-AFT" PLANK ROAD—NOTE THE GUARD RAILS AND THE METHOD OF BRACING THEM

What is considered a great improvement in the "fore-and-aft" construction was effected by putting guard rails in the center at the inner edges of the plank tracks, where they could be cross-braced. This is found to constitute a very safe type of construction, strong and stable, which does not require as many plank as the crosswise type. The guard rails must not extend more than 6 in. above the plank, so that they will clear the brake rims of the trucks. They are spiked to the sleepers with ½-in. boat spikes 12 in. long, and are braced with spreaders of such material as is at hand.

With the center guard rail design, the construction must change to cross-planking where turnouts are provided. The turnouts are put in every 500 ft. on tangents, and on all curves which do not admit of a clear view to the next turn. Turnouts for trucks with trailers must be 70 ft. long. They call for 38 planks, 18 ft. long, with a run-off of four 16-ft., four 14-ft., four 12-ft. and four 10-ft. planks at each end.

TABLE I. LABOR COST ON AN 8-FT. CROSS PLANK-ROAD

Item	Cost per Linear Foot of Road
Clearing 20 ft. wide and grubbing 14 ft. wide	$0.15
Grading	.45
Laying four poles	.20
Laying plank	.10
Total	$0.90

The labor cost for the cross-plank construction is given in Table I. To this must be added the cost of timber felled on the right-of-way, the timber used for stringers, the cost of plank delivered, and the cost of spikes delivered. Four 7-in. spikes were used per foot.

Table II shows the labor cost for constructing the two-track type. To this must be added the cost of timber felled on the right-of-way, the timber used for sleepers and guard rails, the cost of plank delivered, the cost of spikes delivered (two 7-in. spikes per foot), and the cost of boat spikes for the guard rails. Through swampy ground, poles are recommended for use under the sleepers. This gives an additional cost of 15c. per foot, plus the cost of stumpage, plus an extra 5c. per foot for labor on the sleepers. Table III gives the rates for labor and materials on this work.

TABLE II. LABOR COST ON "FORE-AND-AFT" PLANK ROAD

Item	Cost per Linear Foot of Road
Clearing 20 ft. wide and grubbing 14 ft. wide	$0.15
Grading	.45
Laying sleepers	.25
Laying plank	.10
Laying guard rail	.10
Total	$1.05

TABLE III. CURRENT PRICES FOR LABOR AND MATERIALS

Swampers	$0.45	per hour
Graders	.45	per hour
Head faller	.60	per hour
Second faller	.55	per hour
Powder man	.60	per hour
Swamper foreman	.72½	per hour
Grade foreman	.87½	per hour
Plank foreman	.60	per hour
Teamster	.50	per hour
Teams	50.00	per month and board
Powder	16.95	per 100 lb.
Fuse	.79	per 100 ft.
Caps	3.25	per box
Spikes	4.95	per 100

The cost data were supplied by George W. Gauntlett,

SLEEPERS ARE LAID TO LINE AND GRADE AND ON FOUR-FOOT CENTERS READY FOR THE PLANK TRACKS

district superintendent for the Warren Spruce Co., at Raymond, Wash., to whom credit is due for pioneer work in the design and construction of plank roads of high quality.

Motor Trucks Haul Spruce Logs for Airplane Stock

TRANSPORTATION of logs for airplane stock by motor trucks in the forests of the Northwest has played an important part in the rapid development and success of the Government's Spruce Production Division.

Motor trucks have been used both in the construction work and in the actual delivery of spruce logs from regions where the spruce stand is light, and are reported to have proved very effective. They are expected to continue in the latter service as long as airplane stock is being produced, because it is believed that no other means of transportation would serve as well with the heavy loads and over the steep grades that are encountered.

Reports of truck operation in the various districts are best represented, perhaps, by the records of the 143rd Motor Truck Squadron, operating on the Olympic peninsula out of the town of Joyce, Wash. Road conditions there are entirely different from those under which the commercial vehicle ordinarily operates. The average haul is about 30 miles over a graveled country road, the greater part of which is on grades ranging from 3 to 10%. Motor trucks were put in service on June 25 last, and have frequently been operated 18 hours per day, the average being 14 hours. For the first three months they worked under dry weather conditions, but since then the rainfall has been almost continuous, so that the roads, being on poor foundation, have steadily deteriorated.

Owing to the frequent recurrence of emergency conditions, all the trucks were often loaded beyond capacity. The 5-ton trucks were carrying up to 6½ tons, the 2-ton models 3 tons, and the 5-ton with trailer sometimes as much as 15 tons. In the latter case the loads consisted of donkey engines and other machinery which had to be delivered with the greatest possible dispatch.

In the first four months of service the trucks averaged close to 5000 miles. At the end of this period no one of the trucks had received a general overhauling, and all of them were still hauling capacity tonnage or more. The reports show that the only renewals required were minor parts incidental to the general maintenance of the motors, such as carburetors, springs, spark plugs, fan-belts and bolts, or an occasional connecting-rod bearing.

The average gasoline consumption for the 5-ton truck was 3.1 miles per gallon; for 5-ton with trailer, 2.6 miles per gallon, and for the 2-ton model 5.6 miles per gallon. Using heavy oil, an average of 68.1 miles per gallon of lubricating oil was shown by the records of the 2-ton trucks; 51.6 miles for the 5-ton trucks, and 42.3 miles for the latter with trailer.

On the 2-ton model, using 36 x 6-in. solid tires, the average life of rear tires was about 2500 miles. At the end of four months of service it had not been necessary to replace any of the front tires. On the 5-ton truck with 40 x 6-in. dual solid tires the replace-

FIVE-TON TRUCKS WITH TRAILERS HAUL LARGE SPRUCE LOGS ON PLANK ROAD

ments have been confined to the inside treads. This is believed to be because the road has a crowned surface which throws the load chiefly on the inside tread. Most of the trucks have run their average of about 5000 miles without any spring breakage whatever. In the few cases where it has been necessary to replace springs broken in carrying heavy loads over the rough roads, the breakage is regarded as caused more by accident than by wear. The only tonnage records available are those for the month of October, covering the operation of 39 trucks. Of these 10 were 2-ton, 20 were 5-ton, and 9 were 5-ton with trailer. This was not a maximum month as it included 13 rainy days with consequent bad effect on the roads. For this month the mileage records were as follows:

ON STEEP GRADES AUXILIARY TRUCKS ARE SOMETIMES NECESSARY

Miles traveled	38,394
Miles loaded	20,214
Tons hauled	4,500
Gallons of gasoline consumed	11,722
Gallons of oil consumed	2,553

The costs in fuel oil, gasoline and tires are considered to reflect, primarily, the degree of attention given to keeping the trucks "tuned up" and the fact that only competent drivers were permitted to handle them.

In districts farther south than the Olympic peninsula, where plank roads have been very generally used, the tire wear has been less and, because of better roadbed, even heavier loads have been handled in emergencies. Such a road with several loaded trucks and trailers is shown in one of the views. On one road there is a 15% planked grade coming out of the woods and a 19% planked grade going into the woods. Tire chains are not used. On plank roads their wear on tires and plank is excessive, and the use of cross planks on grades, keeping them lightly covered with screenings, makes chains unnecessary, it is generally considered. In taking the heavier loads up grades of 15% or more, it has sometimes been necessary to use a helper truck attached by means of a chain to the truck carrying the load.

A feature of the work which should not be overlooked is the skill required in driving the loaded trucks down steep grades (up to 18%) having sharp turns. On one of these grades which was used temporarily there were blind curves of such radius that the loaded truck and trailer could just make the turn without backing. Under these conditions, it is apparent, the safety of truck and driver depend upon absolute control of the machine at all times. It is the custom to come to a stop just at the top of the hill and begin the descent very gradually. Considering the difficulties under which the work had to be done, the almost entire absence of serious accidents in the several districts is considered most remarkable, and is attributed largely to the skill of the drivers, all of whom are Government-trained men.

Various makes of motor trucks are used. Those referred to in the table, covering 39 machines on the Olympic peninsula, are all Government model standard trucks. On the planked-road district to which specific reference is made both standards and manufacturers' models are in use.

Supreme Court Fixes Responsibility of Contracts

Contractor Not Answerable for Consequences of Defects in Plans and Specifications—Spearin Case Decided

A DECISION of far-reaching importance to engineering contractors was rendered by the Supreme Court of the United States, in an opinion by Justice Brandeis, delivered Dec. 9, 1918. This decision sets at rest a question which has long been disputed, as to the extent of responsibility incurred by a public authority or other owner of work tendering plans and specifications on which a bidder based his proposal for doing the work. Some of the courts—and notably, the House of Lords, the highest legal tribunal of Great Britain—have held that an owner makes no warranty of plans and specifications tendered to a contractor in preparation for bidding, but that it is the duty of the bidder to decide for himself whether the plans are practicable. This conclusion was vigorously denied by the Supreme Court of Wisconsin in a decision which has been regarded in this country as laying down the sounder rule that the party who prepares plans and specifications impliedly warrants their sufficiency, and that the contractor cannot be held responsible for the failure of the work, if he complies with the owner's plans and specifications. The authority of the Wisconsin case has now received the approval of the Supreme

Court of the United States and may be regarded as definitely settling the question for the American courts.

Spearin, the claimant, was the contractor for a dry dock at the Brooklyn Navy Yard, to be built in accordance with plans and specifications which had been prepared by the Government. The site of the dry dock was intersected by a 6-ft. brick sewer, and it was necessary to divert and relocate a section thereof before the work of constructing the dry dock could begin. The plans and specifications provided that the contractor should do the work, and prescribed the dimensions, material and location of the section to be substituted. All the prescribed requirements were fully complied with by Spearin, and the substituted section was accepted by the Government as satisfactory. It was located about 37 to 50 ft. from the proposed excavation for the dry dock, but a large part of the new section was within the area set aside as space within which the contractor's operations were to be carried on. Both before and after the diversion of the 6-ft. sewer, it connected (within the Navy Yard, but outside the space reserved for work on the dry dock) with a 7-ft. sewer which emptied into Wallabout Basin.

About a year after this relocation of the 6-ft. sewer there occurred a sudden and heavy downpour of rain coincident with a high tide. This forced the water up the sewer for a considerable distance, to a depth of 2 ft. or more. Internal pressure broke the 6-ft. sewer as so relocated, at several places, and the excavation for the dry dock was flooded. Upon investigation it was discovered that there was a dam from 5 to 5½ ft. high in the 7-ft. sewer; and that dam, by diverting to the 6-ft. sewer the greater part of the water, had caused the internal pressure which broke it.

Both sewers were a part of the city sewerage system, but the dam was not shown either on the city's plan nor on the Government's plans and blueprints, which were submitted to Spearin. On them the 7-ft. sewer appeared as unobstructed. The Government officials concerned with the letting of the contract and construction of the dry dock did not know of the existence of the dam. The site selected for the dry dock was low ground, and, during some years prior to the making of the contract, the sewers had from time to time overflowed, to the knowledge of these Government officials and others. But the fact had not been communicated to Spearin by anyone. He had, before entering into the contract, made a superficial examination of the premises and sought from the civil engineer's office at the Navy Yard information concerning the conditions and probable cost of the work; but he had made no special examination of the sewers nor special inquiry into the possibility of the work being flooded thereby; and had no information on the subject.

Contractor Refuses to Resume Operations

Promptly after the breaking of the sewer, Spearin notified the Government that he considered the sewers under existing plans a menace to the work, and that he would not resume operations unless the Government either made good or assumed responsibility for the damage that had already occurred, and either made such changes in the sewer system as would remove the danger or assumed responsibility for the damage which might thereafter be occasioned by the insufficient capacity and the location and design of the existing sewers. The estimated cost of restoring the sewer was $3875. But it was unsafe to both Spearin and the Government's property to proceed with the work with the 6-ft. sewer in the condition in which it was then.

The Government insisted that the responsibility for remedying existing conditions rested with the contractor. After 15 months spent in investigation and fruitless correspondence, the Secretary of the Navy annulled the contract and took possession of the plant and materials on the site. Later the dry dock, under radically changed and enlarged plans, was completed by other contractors, the Government having first discontinued the use of the 6-ft. intersecting sewer, and then reconstructing it by modifying the size, shape and material so as to remove all danger of its breaking from internal pressure.

Supreme Court Affirms Judgment

The Court of Claims gave judgment in favor of the contractor, holding the annulment to have been wrongful, and adjudged to the contractor his reasonable expenditures in the performance of the contract up to the time of the breach, plus $60,000, the profits which he would have made if the Government had complied with its obligation and the contractor had completed performance. The Supreme Court affirmed that judgment. Its more important rulings are contained in the following extracts from the opinion:

"If the contractor is bound to build according to plans and specifications prepared by the owner, the contractor will not be responsible for the consequences of defects in the plans and specifications."

"This responsibility of the owner is not overcome by the usual clauses requiring builders to visit the site, to check the plans, and to inform themselves of the requirements of the work."

Reference is made to several previous decisions of the Supreme Court, where it was held "that the contractor should be relieved, if he was misled by erroneous statements in the specifications," and it was stated that "Spearin was under no obligation to repair the sewer and proceed with the work while the Government denied responsibility for providing and refused to provide sewer conditions safe for the work."

Schools at Dam Construction Camps

Camp schools at four of the dam-construction camps of the Miami flood-protection works have begun the year with 109 pupils. At Taylorville and Germantown camps schoolhouses have been built, at Englewood an old residence has been converted into a school, and at Huffman an existing schoolhouse has been taken over. Besides the regular school studies, there will be vocational training in carpentry, blacksmithing and simple domestic science. To serve the employees, night school is held two nights a week. The night-school studies include advanced mathematics, industrial arithmetic, penmanship, English for foreigners, mechanical drawing and first-aid work. The schoolhouses are also utilized as community halls and for church services. A special effort is being made to instruct foreigners in the ideals of American life. Instruction is free.

Structural Shop Diverted Largely to Ship Fabrication

Ferguson Company at Buffalo Fabricates Steel for Tugs and Barges with Minor Changes In Its Old Shop

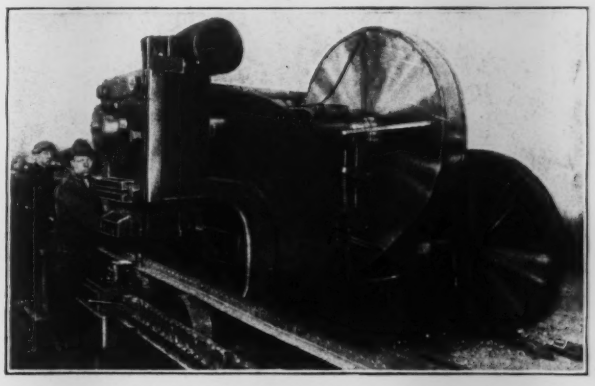
STEEL tugs of extreme complication of line and structure, and steel barges of the simplest straight-line type, are being built at the new shipyard of the Ferguson Steel and Iron Co., at Buffalo, N. Y. Both types of vessel are being fabricated at the structural shop of the company, where only a small amount of additional equipment has been installed and where the new ship-fabrication work now constitutes most of the production of the shop. The adaptability of the ordinary structural shop to ship work is thus being tested here with extreme types of ship framing.

The Ferguson Steel and Iron Co., started in 1913 as a steel warehousing proposition, grew very rapidly, until in the summer of 1917 it completed a new and exceptionally well laid out structural shop, which, in combination with an integrally connected warehouse, was capable of turning out 2500 tons of structural material and 2000 tons of warehouse material each month. A description of the new plant appeared in *Engineering News-Record* of Aug. 23, 1917, p. 362.

In the spring of this year the company decided to go into the shipbuilding business, and, following the obtaining of contracts for Navy tugs and New York Barge Canal barges, started to build the new shipyard described in *Engineering News-Record* of Nov. 7. This yard is planned to be self-contained in the future; in it ships will be fabricated as well as erected. Up to the present the fabricating shop has not been built, and all of this work is being done at the main plant of the company, two miles away, material being transported mainly by rail, but occasionally, when more speed is required, by motor truck.

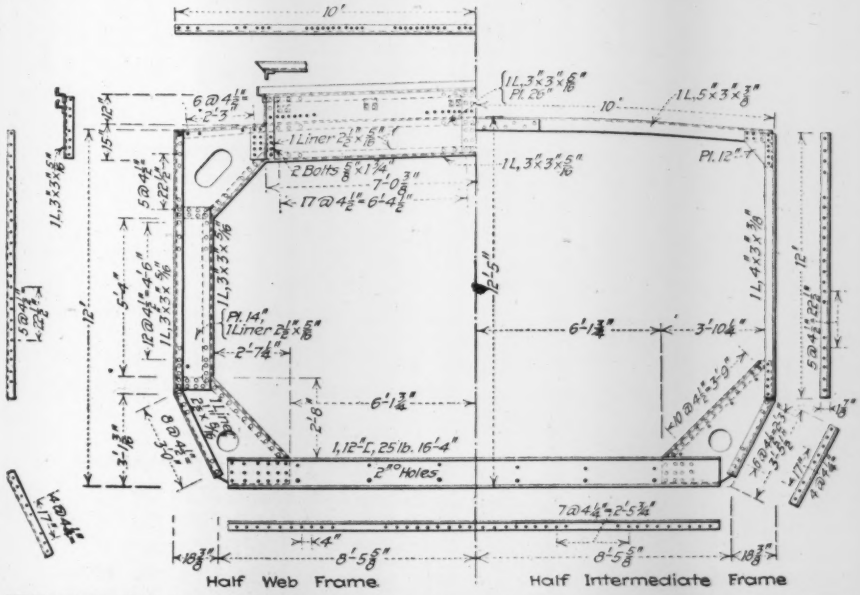
The contracts now held by the company comprise one for six Navy tugs and one for the fabrication of 24 canal barges, 16 of which are to be assembled in the company's shipyard and eight to be shipped to outside yards for which the fabricating is being done.

The tugs are 150 ft. long and have 1000 tons dead weight carrying capacity. They are for ocean use and are heavily built and engined, as befits such use. The boats were designed by the Navy Department after accepted models of this type of craft, and have no concessions whatever to structural-shop fabrication. Nearly every plate is curved, and the frames are not only curved, but are of bent shapes requiring special forging work. The barges are of 150-ft. length, 20-ft. beam and 12-ft. depth, containing about 140 tons of steel. They are of the simplest shape and construction, as the accompanying cross-sections indicate. Ordinary structural shapes in straight lines are used for the whole vessel, except for a slight curving of the bilge and of the bottom members at the bow and stern, which are of duplicate design.

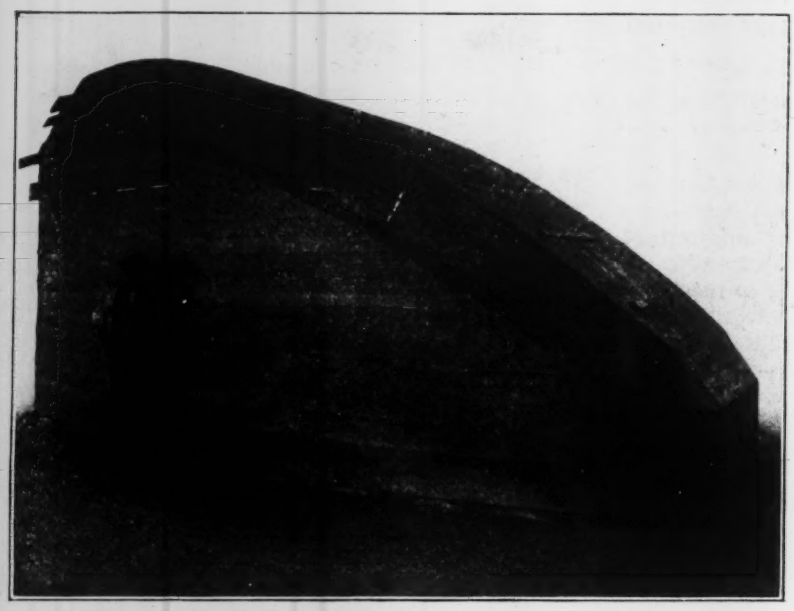


THIS MAN PUNCHED 18,624 RIVET HOLES IN SHIP ANGLES IN A 10-HOUR DAY

The only building addition to the structural shop is a mold loft which has been erected alongside the shop itself. This loft is one of the Ferguson company's standardized factory building types, one story high and 200 x 50 ft. in plan. In it at present are being laid out the frames and plates for the tugs. The barge being of such simple lines as not to require any mold-loft work, instead there has been built a wooden model, shown in one of the views, reproducing in full size one-half the width of the duplicate bow (or stern) of the barge, and a length extending to the first straight strake beyond the curved end. From this full-size model the rivet holes and plate dimensions were laid out. This model was erected not in the mold loft but in the templet shop, which is part of the main structural



NEW YORK CANAL STEEL BARGE HAS LINES ADAPTED FOR STRUCTURAL SHOP FABRICATION



MODEL OF HALF OF CURVED END OF BARGE WAS USED FOR MAKING TEMPLETS

shop. For the straight part of the barge no laying-out work was required.

The shop had not been hitherto provided with any furnace equipment. There was added, therefore, as an integral part of the warehouse end of the combined shop and warehouse building a lean-to containing two new furnaces, one a plate furnace 21½ ft. by 10 ft. and another a shape furnace 40 x 6 ft. These furnaces open into the warehouse connection to the structural shop onto bending slabs in a space which before has been used for storage of cut-to-length material en route from the warehouse to the shop. The slabs are immediately alongside the first of the old angle punches with which the shop was equipped. A great amount of the angle forging for the tugs is being done in the already established blacksmith shop. The extreme complication of the tug framing makes this work slow and expensive.

For the present all punching is being done on the existing beam and angle punches, but multiple plate punches are to be installed as soon as possible. Punches will be also installed in a portion of the assembling space, which is not utilized because little assembling is done on the ship work. Very rapid work has been done on rack punches in the barge fabrication. For instance, one man with a helper, shown in one of the views at the machine, after a speeding-up effort of two to three days, punched in one 10-hour day 18,624 holes, which, it is said, is a record for this type of work. The punching was done on angles and was single-line work, generally about 4-in. spacing.

A final addition is the plate bender, which has been placed in the center of the shop just beyond the punches and leading to the riveting table, where the frames and bulkheads are assembled. A rotary scarfing machine has been added for scarfing plates.

No assembling of the tug frames is done at these shops, but the barges are assembled there by frames and bulkheads. A cross-section of the barge, showing a web frame and an intermediate frame, is given in the accompanying drawing. The bulkhead sections, of which there are four to each barge, are framed in the shop complete. The web and intermediate frames are fabricated in the shop in four pieces, as shown in the drawing—one bottom, one top and the two sides—and in erection require only 22 field rivets.

An innovation in the Ferguson plant is the detail shop. This section of the building was originally designed for a job shop, but since shipbuilding work has started it has been turned into a special detail section. Here all of the detailing for the ships, and incidentally for any other structural work the shop may be doing, is concentrated. Brackets, hangers, etc., are turned out as quantity work by a gang which is engaged only in this kind of construction.

Fabricated material is shipped to the shipyard, as a rule, on freight cars which are brought directly to the end of the shop and which also enter the shipyard. Although the two plants are only two miles apart, they are on different railroads and the cars have to go through an interchange yard, so that it generally takes about two days to get material across. In the earlier work in the yard the speeding up of ship erection was so great as to keep the shop up to capacity, and at such times transportation of material was made with motor trucks. This is, however, very much more expensive than the rail transportation and is resorted to only in cases of emergency.

The regular drafting-room force of the company detailed both tugs and barges. It is an interesting commentary on the types of ships that the shop pound-for-pound cost of the tug fabrication amounted to about three times the cost of the barge details. The Ferguson company spent $4000 in detailing the barges, of which they had at that time 24 under contract. Other companies having this same barge to build had to spend a similar sum in their drafting-room operations, although the finished shop drawings of the various companies were almost identical.

The Ferguson Steel & Iron Co. was founded by James E. Ferguson, who is president of the company and who has recently given up his commission as captain in the Signal Corps, U. S. A., in order to devote all his attention to the very necessary ship work which he has under way. The shop additions and operations are in charge of Thomas Leach, chief engineer of the company.

Dayton Plans Public Improvements

A special public vote is proposed at Dayton, Ohio, on a program of street, sewer and other improvements involving about $2,000,000. The only money otherwise in sight for such work for 1919 is about $300,000 for streets and sewers and $60,000 for water-works extensions and improvements.

The Influenza-Pneumonia Pandemic in United States Army Camps

Over 1 in 5 Had Influenza and 1 in 30 Had Pneumonia—Combined Death Rate Exceeded 14 per 1000

By Major George A. Soper

Sanitary Corps, United States Army, Office of the Surgeon General of the Army

THE influenza-pneumonia pandemic swept through the Army camps in the United States with great rapidity and intensity. Within about two months it had come and gone, so far as its violent manifestations were concerned.

To Nov. 21, 1918, the total number of cases of influenza reported from all troops in the United States has been 321,938; pneumonia, 52,777; deaths, 21,177. The strength has been about 1,500,000 men.

Although the outbreak is generally supposed to have begun in Spain, it is doubtful if it really started there. It might have begun in the United States. Certainly, a distinct wave of influenza passed over this country last spring. An epidemic of about 4000 cases, in a strength of about 28,000, was reported by the present writer from the Oglethorpe group of camps in March, 1918. In the latter part of March the disease appeared in the American Expeditionary Force, in the French and British armies and in the civil populations of Europe. The first cases in Germany were among troops which fought with an American regiment in July. The disease in this first wave was relatively mild.

During the summer, cases of influenza accompanied by peculiarly fatal pneumonia were brought to various ports along the Atlantic coast of the United States. It does not appear that this severe type of infection existed in the ports from which the vessels came. Some persons are of the opinion that the virulence was increased on shipboard. From the ships the disease spread to the land.

In September Camp Devens, Ayer, Mass., became affected from an epidemic in the neighboring civil population. Other camps almost simultaneously reported epidemics. The order of attack, showing the rapidity with which the disease swept through the principal camps of the country, is given in Table I.

Preventive measures were employed at all the camps, first to exclude the disease and later to limit it. It has not appeared as yet that any of these measures have been particularly successful. The prevention of respiratory infections, in and out of this pandemic, has been the least understood sanitary problem presented by the war.

The underlying principle upon which most of the suppressive measures have been based is isolation. The intention has been to prevent the formation of the link which binds one case with another. This has been attempted by separating the men as much as could be by space, masks and cubicles. A feature of the anti-epidemic work was an educational campaign designed to teach the men how they could help.

The data herein are based on daily telegraphic reports sent to the Surgeon General of the Army at Washington, and are the most accurate available at this writing. From the beginning a large amount of data has been collected and, as rapidly as received, tabulated, thrown into graphic form and assimilated. Important facts have been revealed. Tables II and III are presented by permission of the Surgeon General.

TABLE I. ORDER IN WHICH THE CAMPS WERE ATTACKED

Order		Date	Order		Date
1	Devens	Sept. 12	11	Greene	Sept. 26
2	Upton	Sept. 13	11	McClellan	Sept. 26
3	Lee	Sept. 17	12	Kearny	Sept. 27
4	Dix	Sept. 18	12	Bowie	Sept. 27
4	Jackson	Sept. 18	13	Johnston	Sept. 28
5	Hoboken	Sept. 19	13	Sheridan	Sept. 28
5	Syracuse	Sept. 19	14	Sherman	Sept. 28
5	Gordon	Sept. 19	14	Dodge	Sept. 29
5	A. A. Humphreys	Sept. 19	14	Shelby	Sept. 29
6	Logan	Sept. 20	15	Custer	Sept. 30
6	Funston	Sept. 20	16	Hancock	Sept. 30
6	Meade	Sept. 20	16	Travis	Oct. 1
7	Grant	Sept. 22	17	Cody	Oct. 3
7	Zachary Taylor	Sept. 22	18	Forrest	Oct. 6
8	Sevier	Sept. 23	19	MacArthur	Oct. 7
8	Lewis	Sept. 23	20	Fremont	Oct. 8
8	Newport News	Sept. 23	21	Wadsworth	Oct. 11
9	Pike	Sept. 24	21	Wheeler	Oct. 11
10	Beauregard	Sept. 25	21	Greenleaf	Oct. 11
10	Eustis	Sept. 25	22	Las Casas	Oct. 29

TABLE II. CASES AND DEATHS AMONG TWENTY CAMPS ARRANGED ACCORDING TO THE CHRONOLOGICAL ORDER OF THEIR ATTACK

	Total Cases Infl.	Total Cases Pneu.	Total Deaths Pneu.	Per Cent. Attacked Infl.	Per Cent. Pneu. to Infl.	Per Cent. Deaths Pneu.
Five camps attacked Sept. 12-18[1]	46,569	7,968	3,000	21 4	17 1	37 6
Five camps attacked Sept. 22-24[2]	44,000	8,011	2,867	21 4	18 2	35 7
Five camps attacked Sept. 29-Oct. 1[3]	36,044	7,387	2,484	23 8	21 8	31 7
Five camps attacked Oct. 3-11[4]	20,096	1,837	579	28 9	8 9	31 5

[1] Devens, Upton, Lee, Dix, Jackson
[2] Grant, Zachary Taylor, Sevier, Pike, Newport News.
[3] Sherman, Dodge, Shelby, Custer, Travis.
[4] Cody, Forrest, MacArthur, Wadsworth, Greenleaf.

TABLE III. INFLUENZA, PNEUMONIA AND DEATHS IN THE LARGE CAMPS FOR PERIOD SEPT. 12 TO OCT. 31, 1918, INCLUSIVE

	— Cases —						
GROUP I	Infl.	Pneu.	Total Deaths	Per Cent. Attacked Infl.	Per Cent. Pneu. to Infl.	Per Cent. Deaths Pneu.	Duration Epidemic, in Days
Cody	2,337	252	46	49 8	10 8	18 2	26
Beauregard	5,252	1,007	422	39 6	19 2	41 9	36
Wadsworth	5,505	357	60	38 6	6 5	16 9	20
Bowie	4,052	119	104	38 1	2 9	89 8	32
Hoboken	13,563	2,280	794	30 5	16 9	34 9	42
Devens	13,398	2,288	794	30 1	17 1	34 9	49
GROUP II							
Dodge	9,398	1,847	570	29 0	19 7	30 8	32
Custer	11,626	2,437	669	29 0	20 9	27 8	31
MacArthur	6,010	852	188	28 1	14 1	20 4	24
Meade	11,449	2,013	796	27 8	25 3	27 4	41
Pike	13,273	1,379	455	26 7	10 3	32 7	37
Grant	10,717	2,335	1,068	25 8	21 8	45 7	39
Greene	4,200	626	258	25 8	14 9	41 8	30
Funston	13,526	2,328	888	24 9	17 2	37 4	41
Forrest	2,307	33	22	24 9	1 1	66 6	23
Travis	8,470	1,742	168	24 7	20 5	9 0	30
Logan	3,137	393	16	24 6	12 4	3 8	41
Lee	11,298	1,919	672	22 9	17 0	34 6	43
Hancock	7,715	1,209	462	22 2	15 8	37 4	31
Sheridan	4,758	521	132	20 4	10 3	24 6	28
Greenleaf	4,747	343	263	20 3	7 2	75 2	20
GROUP III							
Zachary Taylor	11,587	2,800	830	19 2	24 2	29 0	39
Dix	9,283	1,673	829	19 0	17 9	49 8	44
Jackson	7,500	1,114	362	18 9	14 9	31 3	43
Shelby	1,761	94	19	18 8	5 3	24 8	28
Syracuse	2,031	401	164	18 4	19 8	40 6	42
Sevier	4,526	896	319	16 3	19 7	35 7	38
McClellan	4,718	993	218	16 1	20 2	21 3	28
Eustis	1,745	67	10	14 8	4 0	16 2	36
Newport News	3,897	601	195	14 2	15 5	30 5	34
Upton	5,090	974	343	13 9	19 2	34 9	48
Sherman	4,789	1,717	1,058	13 5	35 7	61 3	32
Kearny	2,450	186	37	13 5	7 9	19 8	34
Gordon	4,155	626	192	11 3	14 8	30 4	42
Johnston	2,117	383	161	11 1	18 2	40 9	30
GROUP IV							
Fremont	2,347	392	132	9 8	16 1	31 2	23
Lewis	3,141	994	148	9 7	31 6	14 8	33
Wheeler	70	361	61	8	516 0	17 8	..

Stress Measurements on Niagara Gorge Railway Bridges

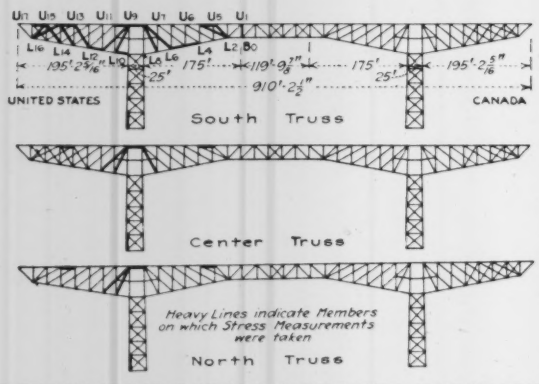
Permissible Loading Studied by Strain-Gage—Dead-Load Condition of Arch Determined by Forcing Crown Apart and Measuring Release of Stress

By Charles Evan Fowler
Consulting Engineer, New York

KEEPING in service the great bridges of the country, vital links in the transportation system carrying troops, supplies and munitions, has called for unusually careful engineering study during the past two years, because of the imperative demands for economy in the use of steel. In the study of two of these bridges, the arch bridge and the cantilever which carry the Grand Trunk and the Michigan Central Railroads over the Niagara Gorge, the analysis by calculation was supplemented by extensive strain-gage measurements of the stresses in the members under actual train loadings, both static and moving. Repairs are being made, on the showing of the stress measurements, to keep the two bridges in the best condition for carrying the enormous traffic passing from the West through southern Canada.

The Niagara cantilever, one of the first large cantilever bridges, is a double-intersection structure with eye-bar tension members. It was originally built with two trusses, but a center truss was added. The Grand Trunk arch is a double-deck structure, carrying a highway under the double-truck railway deck. It is of the two-hinged type; the end hinges are formed by circular rocker seats. In the erection of the arch the closure at the center was made by inserting a shim in the top chord after forcing the two halves of the structure apart by a toggle.

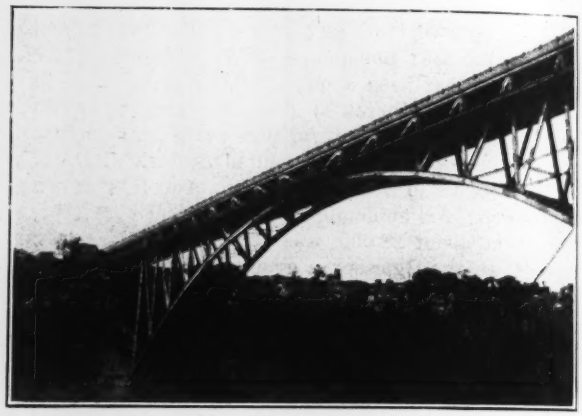
To show how the loads on the bridge distribute between the three trusses, measurements on certain selected members of all three trusses were necessary. As shown by the diagram, three top chord members and two web members in the east anchor arm were used for this purpose. More extended measurements were



ALL THREE TRUSSES OF THE CANTILEVER BRIDGE WERE INCLUDED IN THE STRESS MEASUREMENTS
(Heavy lines indicate members tested)

made on the south truss, as indicated. These latter include all critical members and such as would show the distribution of stresses between the two systems of the webbing and between the bars in a panel; some panels have as many as 14 separate eye-bars.

Wrought iron of very good quality was used in the original structure, except that the tower posts, the bottom chords, center and ends of posts were of high steel. In the new center truss the bottom chords and tower columns are of high steel, while the other members are

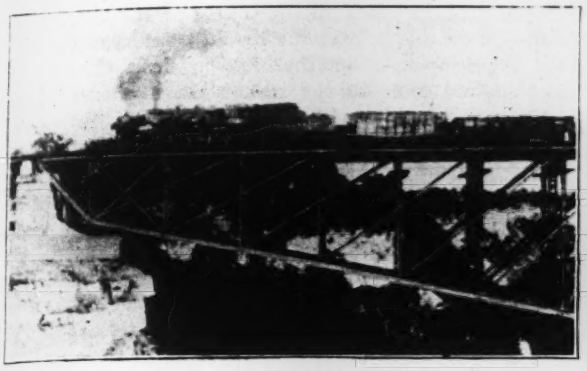


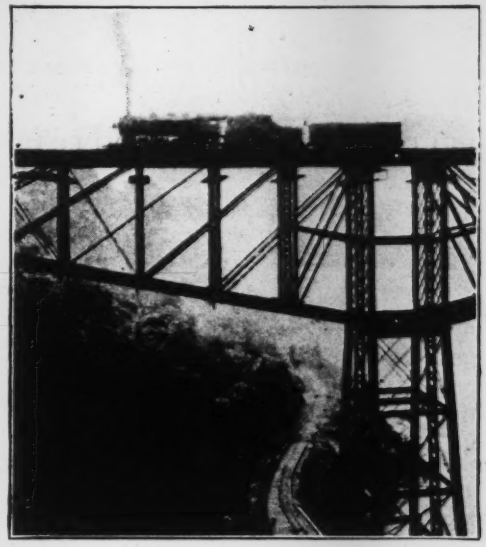
GRAND TRUNK ARCH BRIDGE

of medium steel. The best available data indicated that the moduli of elasticity of the material are: For the eye-bars and the compression members of the top chord of the old trusses, 25,500,000, and for other compression members 30,000,000; for all members of the center truss, except the tower columns, 29,000,000, and for the tower columns 30,000,000 lb. per square inch. These values were used in reducing to unit stresses the observed deformations of the members under load.

Gage points on the members were so located as to avoid so far as possible the regions containing unevenly distributed stress, as in the end details of the members, and also to make the position of the observer as easy as possible in order to assure most accurate reading of the gages. Spots of about 1½ in. in diameter were cleaned off at each gage point; holes for the points were drilled about 0.1 in. deep with a No. 56 drill, the burr was removed with a flat-angle countersink, and the hole was finished by rubbing with a punch. One hole of each pair was finished before the position of the other was marked. A gage bar with two center punches fixed in the ends was used for marking the location of the second hole of each pair. Vaseline was used to protect the holes from rusting between measurements.

Three Berry strain gages reading to 0.0002 in. were chosen for the live-load stress measurements. Two of these, of 20-in. gage length, were used for the greater part of the work, while an 8-in. instrument was used for the floor-beams and for the short diagonal equalizing links. Calibration by standard micrometer screws showed them to read high by 3 to 4 per cent., but the errors were practically constant and well within allow-





THREE OF THE TEST LOADS ON THE NIAGARA CANTILEVER FOR MEASUREMENT OF STRESS DISTRIBUTION

able limits, so that no corrections were made in the results. Two standard bars were made from pieces of ¾-in. gas pipe long enough so that caps screwed on the ends would not interfere with gage points 20 in. apart. An 8-in. length was also marked off on each bar. The caps, after being tightened down, were ground off on one side flush with the pipe, to form a plane surface on which the bar could rest. In each pipe a thermometer was placed at mid-length, and a slot was cut in the pipe over it to allow reading. The observations consisted in each series of (1) a reading of the gage on the standard bar; (2) a group of readings on the bridge members, and (3) a check reading on the standard bar. The thermometer in the standard bar was read for each gage record on the bar. Fourteen special Fahrenheit thermometers, calibrated against a standard, were fastened in close contact with the members of the bridge where measurements were to be taken; their bulb ends were bedded in putty to protect them from the air. It was not considered necessary to have a thermometer on each individual bar when it was measured, but temperatures were estimated from thermometer readings taken at the same time on bars similarly located.

All the thermometers were at all times kept in the shade. As much as 20° difference in temperature existed between different bars of the same members, due to the sun shining on part of them. In making corrections for temperature the coefficient of expansion of the metal was taken as 0.0000065.

Arrangements were made for the use of trains of known weight and wheel spacing. These were placed on the bridge, standing in one position long enough to allow careful readings to be taken on the members. By means of influence diagrams, these loads could be placed in position for maximum stress. Regular trains frequently stopped on the bridge for several minutes, and advantage was taken of this to obtain information on the behavior of the bridge under trains, though, as a rule, it was not practicable to obtain the weight or even the train numbers. More than 1500 readings were taken on the cantilever. Close agreement of calculated stresses and strain-gage stresses characterized the work. However, paradoxically, the distribution of stresses among the several members (of an eye-bar panel, for example) was found to be better under the heavier loadings than under the lighter ones, although, as was to be expected, the secondary stresses were higher under the heavier loading. Many more readings were made on the arch than on the cantilever, on account of the necessity of determining the secondary stresses due to the connections being riveted throughout. Some hundreds of readings were taken under moving trains, at speeds of 5 to 25 miles per hour, in 50 or 60 individual runs. In contrast, few readings under moving trains were taken on the cantilever; the speed there is low and the impact very small.

The highest impact observed in the arch truss members was about 50%. The percentages agreed closely with those given by the A. R. E. A. formula.

Other important matters were studied in the arch bridge by means of the strain gage. One of these was the movement of the segmental bearings which form the hinge joint at the end of the arch span. Another was the measurement of stresses in the swaybracing rods, and the subsequent adjustment of these rods. Most important of all, perhaps, was the determination of the actual distribution of dead-load stress by measuring the compression in the center member of the top chord.

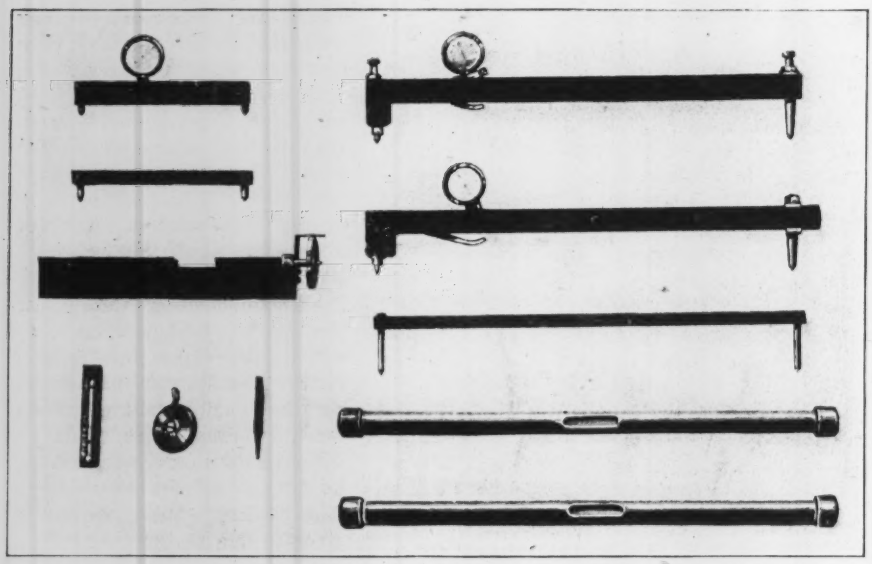
Locomotives weighing about 180 tons each and trains of loaded coal cars weighing from 3800 to 4500 lb. per linear foot were used for the tests. The heaviest loading consisted of two double-headed trains with 14 cars, a frequently possible loading.

Summarizing the work on the arch in a general way, it can be said that the results were very satisfactory. Full study of the readings (now in progress) is likely to show that the arch, after 21 years of service, is in

much better condition than any other bridge of its general character. At it was designed with very low unit stresses for loading less than E40, there will have to be a comparatively small amount of reinforcing to bring the bridge up to E60 loading.

Calculations of stresses will be carried out for every condition of static and dynamic loading, with such allowance for secondary and impact stresses as the strain-gage measurements indicate to be reasonable. When all service stresses, then, are absolutely determined, comparatively high units will be allowed in the members for combinations of coexisting stresses.

Reduction of the readings shows a much closer agreement with calculated figures than other stress measurements of bridges in service have shown. Probably, in part this may be considered due to the care taken in the observations, the correction for temperature, and the multiplication of readings. The instruments used were found to be perfectly satisfactory for practical use, and, in the writer's opinion, much better adapted to work of this character than those of a type which cannot be used for moving loads or which are difficult to employ under vibration of the structure.



INSTRUMENTS USED FOR STRESS MEASUREMENTS ON NIAGARA GORGE BRIDGES

Practical use was made of the strain gage in an unusual way, in the matter of the movement of the segmental rollers which form the hinge bearings of the arch span. The eye was unable to detect any movement. Points were, therefore, set, one on the top and one on the bottom casting of the bearing, for the 20-in. gage. Readings with this gage showed movements under trains of from 1/250 to 1/100 of an inch. Readings taken at varying temperatures led to the conclusion that the maximum movement from the highest summer to the lowest winter temperature, including live-load movements, may reach the amount of 0.1 in. Locking pins which had been fixed in these bearings have now been out for several months, but no signs of creeping can be detected. However, suitable locking devices, allowing free movement, will be added next year.

Running at speed over the bridge produced undesirable swaying, it was found in the course of the tests. This made it desirable to examine the adjustment of the vertical swaybracing under the highway floor. The strain gage showed some of the rods to have practically no initial stress, while others had initial stresses up to 28,000 lb. per square inch, or practically the elastic limit of the iron bars. All the bracing rods were then adjusted by the gage to have 7000 lb. per square inch initial stress. A noticeable increase in the stiffness of the arch resulted.

Uncertainty existed as to the amount of stress in the main members of the bridge from dead load. This was due to the use of a toggle in making the closure of the arch at the time of erection.

The two halves were erected as cantilevers. In the original operation a 1-in. shim was placed between the abutting ends of the top-chord section. It was considered necessary, for full knowledge of the stresses in the arch, to release the stress in the center member of the top chord and thereby determine its dead-load stress; with this figure known all dead-load stresses in the structure could be calculated. For releasing the stress, a special toggle device was built, quite different from the original one used in 1897, when the structure was erected. The special toggle was put in place Oct. 12 and 13, 1918. Additional rivets had been driven in the ends of the old abutment plates on the top chord, 1-in. bars bolted across near the ends of the plates with four 1-in. turned bolts to stiffen them further, in order to prepare the abutment plates for carrying a possible load of 500 tons. Two screw jacks were set just back of this point, inside each chord section, to take up the thrust of the toggle. The operation was carried out Sunday, Oct. 13, between passenger trains crossing at 12 and 4 o'clock, the passage of all other trains having been shut off for the day.

With the splice rivets cut loose on one side of the center joint, and some bolts inserted for safety, the toggle forced apart the joint until the shim would just rattle. Readings on the points set for the gages showed a reduction in stress in the center top-chord section amounting to 689,000 lb., which amount therefore indicated the dead-load compression in this member. This is a very satisfactory condition. Stresses in the arch had been calculated for full three-hinged condition or zero load in the center top chord, and stresses in this member of 200,000, 400,000, 600,000, 800,000, 1,000,000 and 1,200,000 lb. It was therefore possible to pick out a condition that would best serve the purpose of equalizing stresses in the various members so as to increase the capacity of the span. It has been decided that a stress in the middle section of the top

chord of about 350,000 lb. is desirable. To secure this end, the 1-in. shims will be removed later on, by using the toggle in somewhat modified form, and thinner shims inserted. The arch will then be somewhat nearer the three-hinged condition for dead load than it is at present; the stress in the top chord, and in the posts and diagonals will be reduced, and thus these members will be materially strengthened.

Thanks are due the owners of the two structures, whose farsightedness made possible this extensive investigation of two of the most remarkably designed of our great bridges. Acknowledgment is also due to H. G. Dickenson, superintendent of the Niagara Railway Arch Bridge, to J. F. Deimling, chief engineer, and H. Ibsen, special bridge engineer of the Michigan Central Ry., for permission to publish this account of the methods employed, and to their field assistants for coöperation in the work. The measurements themselves were carried out by the writer, assisted by Prof. C. T. Morris and Prof. A. H. Fuller.

"Imaginative" and "Speculative" Highways for Tomorrow

In Planning, Broad Vision Will Be Necessary—Roads Will Be Built Much Wider and Stronger, and Aesthetics as Well as Utility Will Affect Design

By H. G. Shirley

Secretary, Highway Industries Association

(From paper read before the Joint Highway Congress, Chicago, Ill., Dec. 12, 1918).

IN CONSIDERING "The Highways for Tomorrow," we must not set small limits for them in our minds, for the picture, as I see it, is one of magnitude, beauty and great material and recreational value to all the people. For the sake of distinction, I have separated these highways under two heads; the "Imaginative" and the "Speculative," and have made a further separation into national, state and county highways.

The "Imaginative" road is a dream of what the roads of our country will be 10 or 20 years from today. The "Speculative" road is what we estimate they will be, basing our assumption on past experience and what has been accomplished, as a basis of calculation. National highways will be built and maintained by the Federal Government, the state highway by the state, and the county highway by the county; furthermore, each group will be composed of three classes, such as Class A, B and C.

Class A National Highways

Class A, national highways, will be the main trunk highways passing through a state, connecting up the main centers of population, and serving the most densely populated sections, where the greatest volume of traffic will be found. The volume of traffic on a Class A road will not be less than 2500 tons per day. The width of the right-of-way will not be less than 100 ft., and the surfacing not less than 60 ft. The surfacing will be of the most durable materials, and designed to carry a moving load of 20 tons; 12 tons being concentrated on the rear axle of the vehicle.

All grade crossings of railways or trolley lines will be separated by overhead or undergrade crossings, and intersecting roads will have a clear vision, at all intersections, of 50 ft. or more. Large expenditures will be made to straighten alignments and in the reduction of grades. The surface will be smooth, giving the least amount of tractive resistance and vibration.

Curbs, gutters, inlets, catchbasins, and a complete subsurface storm-water drainage system will be provided. A sufficient width on either side of the roadbed will be set aside for the planting of trees and the laying of sidewalks, conduits, pipe lines and other surface or subsurface structures; also for buildings for public use, such as rest sheds and comfort stations.

All curves will have a vision of at least 400 ft., and the roadbed and surface around all curves will be elevated from the inner edge to the outer edge, the elevation being computed for the degree of curvature and for a speed of at least 35 miles per hour.

Great care will be taken in laying out and establishing a Class A road. Points of interest and of historical value will be marked with suitable tablets, or monuments, or other devices—the proper arrangement of trees and shrubbery being such as to make the layout most attractive. Care will be taken to have the slopes of the embankments and cuts planted in grass and other suitable foliage.

Direction signs of neat and attractive design will be erected at all intersecting roads. Signs giving the name of the city, town or village will be erected where the national road enters and leaves.

Class B National Highway

The Class B national highway will consist of those roads having a density of traffic of over 1000 tons per day. They will have a right-of-way of at least 80 ft. in width and a surfacing of 40 ft. All drainage will be provided, and where necessary a subsurface and storm-water drainage system will be installed. The surface will be designed to carry the same loads as, and will be constructed of materials similar to those used in, the Class A highways. The treatment of the portion outside of the paved surface and shoulders will be of a rural character, trees being planted which will be both productive and ornamental.

This class of highway will serve sections of the country where the land is practically all under cultivation, where small towns and villages are not far apart, or where industries are established requiring considerable tonnage to be transported over the highway.

Class C National Highway

The Class C national highway will be where the traffic does not exceed 1000 tons per day. It will have a right-of-way of not less than 60 ft. in width and a surfacing of 20 ft., designed for the same loading as Classes A and B.

This class of road will run through sparsely settled sections of the country, tying into Class B highways, and be the artery that will serve remote and densely populated sections of our country. It will make easy and convenient communication among all the people, inducing social intercourse and thereby making us all one great family. Without personal contact, both with persons and things, the East will never understand the problems of the West, nor the North those of the South, and vice versa.

Treatment of the right-of-way of this class will disturb its natural beauty as little as possible, but all means will be taken to bring it out with greater prominence. All historical points will be marked with attractive monuments and tablets. At points where there is beautiful scenery parking spaces will be provided, and observation and shelter sheds erected. Vistas through the trees will be cut at points of vantage, and where beautiful scenery can be opened up. Shelter sheds and lodging shelters will be erected at convenient intervals, and telephones will be installed.

Snow fences—Snow fences or breaks will be constructed on all highways at all points where the snow drifts, relieving as much as possible the necessity of snow removal. With such places protected, snow plows and shovels, operated by tractors and trucks, will keep the roadway free of snow and open to traffic at all times. Where there are heavy falls of snow, the maintenance department will be fully equipped with all necessary equipment and organization to remove the snow quickly after each snowfall. The width of road that will be cleared of snow will depend on the volume of traffic passing over the highway, but under all conditions at least 16 ft. will be cleared.

Guard rails—On Class A national highways, where curbs and gutters have been constructed, no guard rail will be required, except on the outer edge of the sidewalk along embankments to protect pedestrians, and it will be of shrubbery hedges. On Class B national highways, at points where necessary, guard rail of neat design and permanent nature will be erected. Guard rail for Class C national highways will depend on the availability and cost of materials. It will consist of all kinds of materials from concrete walls to large boulders or rustic fences.

Danger signs—Danger signs of standard design will be erected on all highways at approaches to all sharp curves, sudden breaks in a grade where the view is obstructed, and at other points where there are elements of danger. The signs will be equipped with a lighting device to illuminate them properly at night.

Bridges—All bridges on Class A national highways will be at least 50 ft. between the curb lines, with a suitable space for sidewalks. All bridge floors will be of the solid type and designed, with the other portions of the structure, to carry a 20-ton truck on four wheels, the distance between axles being 10 ft., and with a concentrated wheel load of six tons. Close study will be made of each location, and a design selected that will fit in with the general landscape and be most pleasing to the eye. Bridges erected on Class B national highways will be designed for the same loading as on Class A, but will have a roadway width of 40 ft. Bridges on Class C national highways will be designed for the same loading as Classes A and B, but will only have a clear width of roadway of 30 feet.

State Highways of the Future

Class A state highways will be the main arteries in the state, connecting up with the national highway system, or connecting large towns and cities which are not connected by the national system. They will be designed to carry traffic similar to Class A and B national highways and will have a right-of-way 60 ft. in width with a surfacing of 24 to 30 feet.

The treatment of right-of-way outside of the shoulders and gutters will be variable and according to the development of the country through which the roads pass. Spaces for telephone lines, conduits, water mains and other subsurface structures will be provided outside of the surfaced area, and a parking space will be set aside for trees. The general type of treatment of right-of-way will be similar to that of Class B national highways.

Class B State Highway—Class B state highway will have a right-of-way of not less than 40 ft. width and will be surfaced for a width of 18 to 24 ft. Careful study will be made of the traffic and the possible future traffic over this class, so that an accurate estimate can be made of the future needs and the weight of loads that it will be called upon to carry. If the traffic study shows that it will be quite a long time before the road is called on to carry a great amount of traffic, or that the traffic will be of a type that would not call for a strong surface, the surfacing will be designed for a maximum load of 16 tons, with a wheel concentration of five tons on the rear wheels. No greater load should be allowed over this type of road, except by written permission.

Class C State Highway—Class C state highway will be used through sparsely settled sections of the state and will tie into Class B roads, making a connected system. The width of right-of-way will be not less than 30 ft. and the surfacing not less than 18 ft. The surfacing will run from a sand-clay or top-soil road up to a higher type, depending on the availability of materials and climatic conditions.

County Highways of the Future

County highways will be exceedingly variable in the types that will be used, depending on the intensity of traffic. They will range anywhere from the highest type of national highway down to the earth road, which will constitute the greater number of miles in this system. The same markings and care of right-of-way will be taken that will be taken with the same class of state highway.

The earth road will be widened out, the right-of-way cleared for its full width, and the road kept well shaped up and dragged constantly. Much service can be secured from the earth road by properly maintaining the same, and very much greater care and attention will be given to this class of road in the future than have ben given in the past. It will necessarily contain the largest mileage of all the types of roads for many years to come. In the past it has been shamefully neglected and abused, no attempt being made to make

it give that service which it is capable of performing for at least nine to twelve months during the year, depending upon the severity of the climate and the locality.

The above are classes of roads that the speaker imagines and believes will be in universal use in the next 15 to 20 years in this country, and are therefore classified under the heading of "Imaginative" roads.

The "Speculative" Road

We will now take up the second heading, the "Speculative" road. Under this heading, as defined in the beginning, we will have to make a close study of what has been done in the past to see what we may expect in the future and what the "Speculative" road of tomorrow will be.

Highway Development of the Past—It was about 100 years ago that the national Government and a number of the states started a road-building program. The Government built a few hundred miles and the states a similar number. Shortly after the starting of this road program, all road building on the part of the national Government and the states ceased. The work was then taken up by many turnpike companies, which were formed and which built a number of roads in the Eastern states, operating them under the toll system. After the establishment of the toll road there was quite a long period of quietude in road construction. It was handled principally by the township and county officials, with no development in types of construction, or methods of maintenance, outside of the large cities. This condition continued to the late nineties, or practically to 1900, when the states, due to the change in the vehicular traffic passing over the road, saw the coming need of more and better highways, and began to make a study of the problem.

This study has been going on for 18 years, and, granting some progress has been made, there is by far a greater demand for more and better highways today than ever before. Why is this demand so great? It is because we have not kept pace with the requirements and needs of traffic and the development of the country. Therefore, if we should attempt to plan a system of highways, taking the progress of the past 50 years as a basis of calculation, we would fall far below the requirements of the future.

Highway Practice Today—One hundred years ago the national Government laid out the right-of-way for its highways 66 ft. in width and constructed the surfacing from 20 to 30 ft. wide and of considerable depth, yet today we see the main state highway trunk lines and the Federal-aid roads being surfaced from 14 to 18 ft. in width, with a right-of-way in many instances not exceeding 30 ft. and a thickness of surface incapable of bearing the loads now passing over them at critical periods of the year—that is, when the ground is saturated with moisture.

Review of Past Progress

All this is misleading for any basis of calculation and design to meet the future needs of the country's transportation. Let us now examine the mileage of roads constructed from 1909 to 1914, and see what progress has been made. From 1909 to 1914, a period of five years, there were constructed about 75,000 miles of roads, or so-called roads—that is, at the rate of 15,000 miles per year.

There are in this country today, under the headings of national highways, state highways, and county highways, with the exception of Class C county highways, about 500,000 miles of roads that should be improved, and their improvement will be a good investment for the people at large. Yet at the rate we have been going, and using the same character and means of construction, it would take 33 years to complete this mileage. If we constructed this mileage of highways to meet the traffic needs of today and the future, it would take at least 50 years at the rate of expenditure and progress that has heretofore been made. Therefore, any calculation or speculation we may make, using the mileage as heretofore constructed or what has been accomplished as a basis, would give such a small program of construction that it would be a very gloomy day for many of us who hope to see the building of roads put on a basis of keeping pace at least with the development of the country and the needs of transportation.

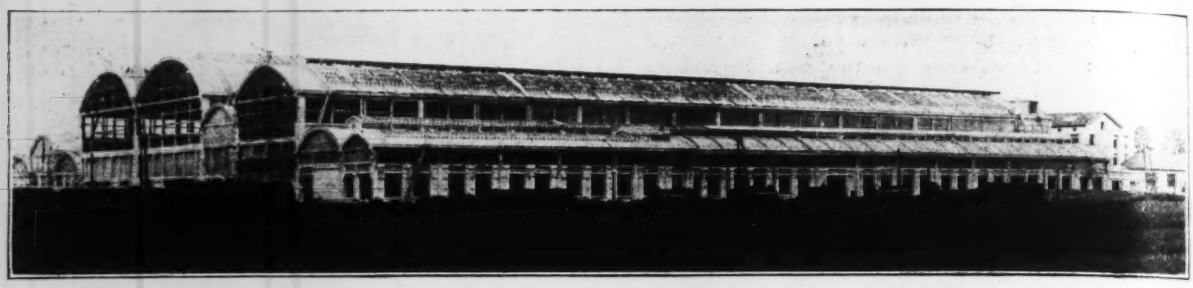
The development of the different types of surfacing is in its infancy, and much study, experimentation and development will be necessary. No field for the manufacturer of road material will offer greater possibilities. It is, however, most important that the highway engineer and the material interests work in closer harmony with each other, so that each type can be developed to the highest degree.

In laying out, constructing and maintaining the American highways for tomorrow, the highway engineer must not be bound by what has been done heretofore, or by any plan based on such accomplishments, but will have to rely to a great extent on his imagination, and picture the needs of and use to which the highways will be put in the future. As a note of warning, may I caution again that the limits of his imagination must not be small or restricted, but must be of wide vision?

Many of you will say that this is a dream of a road dreamer, but some bright morning the American people will awake from their slumbers, and this dream will be a reality and great will be the benefits therefrom.

Chicago Plans Numerous Bridges

A comprehensive program for construction of drawbridges over the Chicago River at new sites, and to replace old structures, which program has been interrupted seriously by the war, will be expedited shortly as a result of the recently altered conditions, it is expected. Most of the work now under way, including the Michigan Ave., Wells St. and Franklin St. bridges, is for substructures. The superstructure of the Monroe St. bridge is practically completed and work will soon be started on that of the Illinois Central bridge for the St. Charles Air Line. Plans are being prepared also by the city for new bridges at Madison, Clark, La Salle and Twelfth Sts., in the business district. The last named includes a long viaduct approach over the railway tracks. In the outlying districts bridges are being planned for No. Kimball Ave., So. Lawndale Ave., and Addison Street.



BUILT BY THE FRENCH, THE NEW SHOP BUILDINGS ARE IMPRESSIVE IN BOTH SIZE AND APPEARANCE

Railroad Repair Shops in France Equipped and Operated by American Forces

Regiment Recruited from Personnel of American Machine Shops Takes Over Group of Buildings Constructed by the French—Individual Electric Drive for All Machine Tools

By Robert K. Tomlin, Jr.
War Correspondent of Engineering News-Record

EQUIPPED throughout with American machine tools and manned by American mechanics from one of our engineer regiments, the great central shops for the repair of both United States and French locomotives and cars have been placed in service, although not entirely completed at this writing, under conditions materially different from those contemplated when the regiment was being recruited in the United States a year ago. Our men expected to arrive in France and find shops built, fully equipped and ready to be taken over for operation by American troops. Almost on the eve of their departure overseas they were informed that upon them would rest the responsibility of obtaining and installing the entire equipment of machine tools, and providing power for running them.

This news, of course, necessitated a sudden and complete revision of the program, and a prodigious amount of rush work right up to the day of sailing. It meant the planning in detail, almost at a moment's notice, of the entire plant layout of a huge railway shop project, a job to which months would ordinarily be devoted. Undaunted by the new turn of affairs, the officers of the regiment, all of them specialists in railway machine-shop practice, set about their task, snatching a few hours' sleep at times, until they finally embarked on their transport with the finished schedule of machine-tool equipment and its layout in the French shops, and with arrangements made for purchase and shipment.

Ground Plan Shows Scope

The new shops, located in the intermediate section, east, of the American Army area, are under the jurisdiction of the general superintendent of motive power of the Transportation Service, which controls all matters of standard-gage railway traffic and maintenance of equipment for the American Expeditionary Forces.

A ground plan of the buildings, Fig. 1, indicates the scope of the project. Starting at one end of the site, there is the boiler shop, where both iron and copper boilers—the latter being common on French and Belgian locomotives—will be repaired. Next come the erecting shops for locomotives and tenders. The machine shop and tool room occupy an adjoining bay of the layout, and succeeding bays contain the electric-welding and boiler-testing shops, the spring, smith and forge shops, and the storeroom. After crossing an open space carrying tracks for incoming and outgoing equipment, one comes to the axle-storage yard, paint shed and wheel shop, and the temporary power plant.

At a near-by site is the car-repair yard, the general features of which are shown in Fig. 2. Here new track had to be laid and facilities provided for disabled storage, tear-down, overflow repair, unfinished-material storage and finished-material storage, in addition to the area devoted to the repair work proper. The car-repair yard has required, in all, about six miles of new track and 44 turnouts.

Enormous Demands on Shops

The need for the locomotive and car repair facilities is apparent when one considers the enormous demands which are being made upon the rolling stock of the various French railroads, in addition to the new locomotives and cars which are received from the United States and assembled here in France. The latest official figures announcing the arrival of American troops at the rate of between 200,000 and 300,000 a month give some indication of the load which is being placed upon the equipment of the steam railways in France. These statistics, as an index of railway traffic, mean not merely that so many thousands of men must be transported from seacoast to training ground, or from one battle sector to another, but that a steady stream of material and supplies must be kept moving after them. The movement of this vast tonnage results in wear and tear on locomotives and cars, to say nothing of the damage suffered by rolling stock subjected to shell fire or bombing. At the time of my visit to the shops there arrived a long train of *hospital* cars, all plainly marked with big red crosses, which had been pretty well shot up by the Boche.

It is true that the French railroads have their own shops, but these have long since been working to capacity, and it would have been out of the question to

have depended upon them for the repair of our railway equipment. In fact, the French are already utilizing our shop facilities and personnel for repairs to their own locomotives. Then, too, with the shipments of rolling stock we are receiving from across the Atlantic the number of engines and cars is constantly growing—not as fast, perhaps, as our railway operating officials would like, but, nevertheless, at a rate which makes obligatory a large-scale plant for repair work.

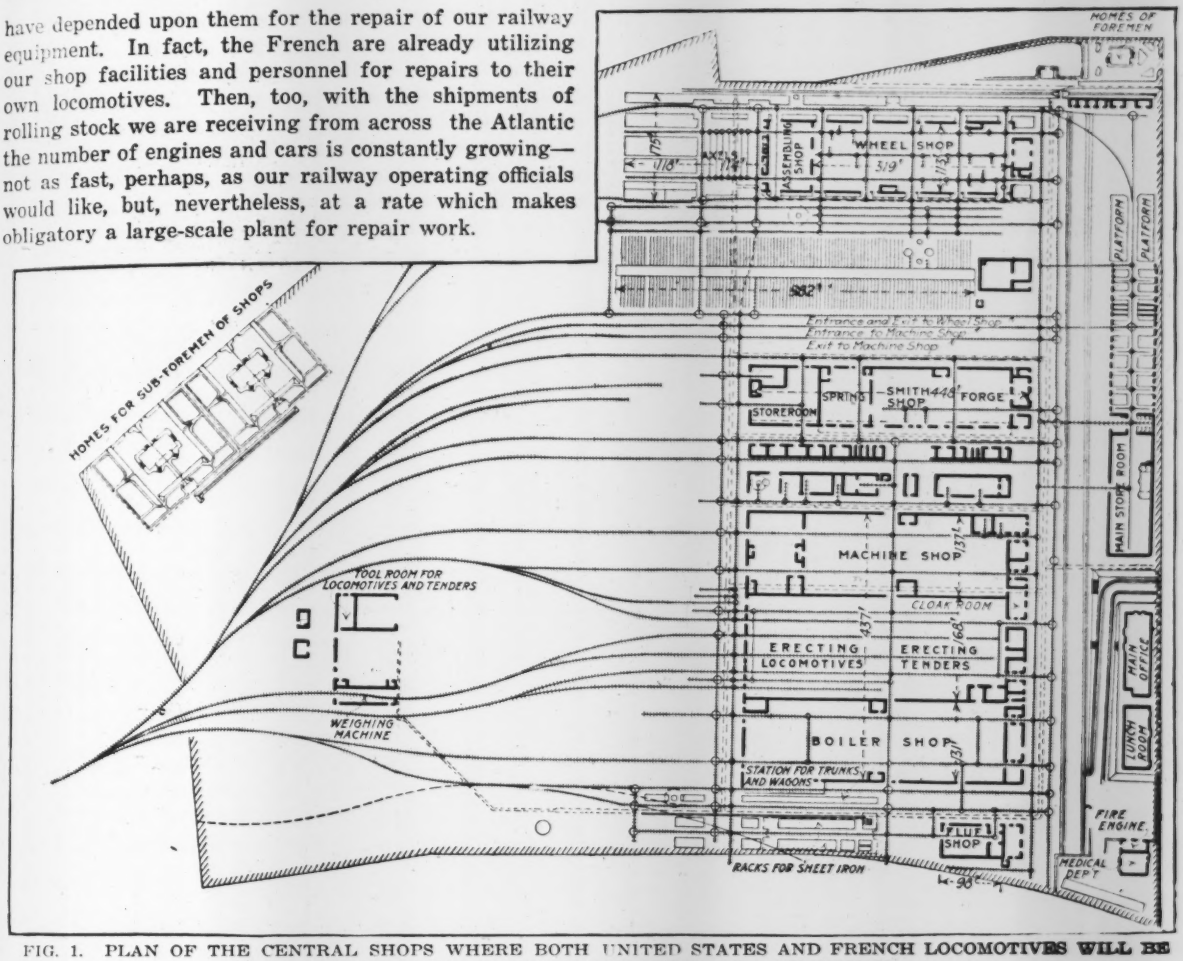


FIG. 1. PLAN OF THE CENTRAL SHOPS WHERE BOTH UNITED STATES AND FRENCH LOCOMOTIVES WILL BE REPAIRED BY AMERICAN ENGINEERS AND MECHANICS

The new shop buildings were constructed by the French. Concrete and steel forming long parallel bays with vaulted roofs have been handled with that artistry and painstaking attention to general exterior appearance which finds no place in the design of the average American industrial building. Here we have a shop for locomotive repair work which might well pass for a horticultural hall at an international exposition. Such results, however, are not achieved on a job where speed records for construction are broken, and it is small wonder, therefore, that the completion of the project, started by the French before the war, extended far beyond the date at which it was thought the buildings would be ready for the use of the American operating force.

It was our job to take the bare shells of these shops, as turned over to us by the French, equip them, and begin repairing railway rolling stock. Pending the completion of these structures and the arrival of our own machine tools, our shop regiment, organized primarily as a skilled operating force, was broken up into several units, some of them going to a base port to assemble American-made locomotives and cars, while others were detailed to duty at various existing repair shops of the French railroads.

This assignment of our men to work among French machines is said to have had both its advantages and disadvantages. The chief benefit has been the opportunity given to American mechanics to become familiar with French and Belgian locomotive construction, for in many features of design these machines are radically different from those of United States types. Inasmuch as our new shops will handle French as well as American work, this period of close contact with French locomotive repairs by members of our

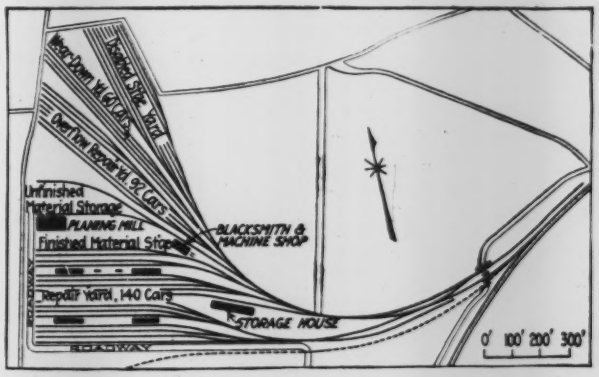


FIG. 2. LAYOUT AT THE CAR REPAIR YARDS, BUILT BY AMERICAN ENGINEER FORCES

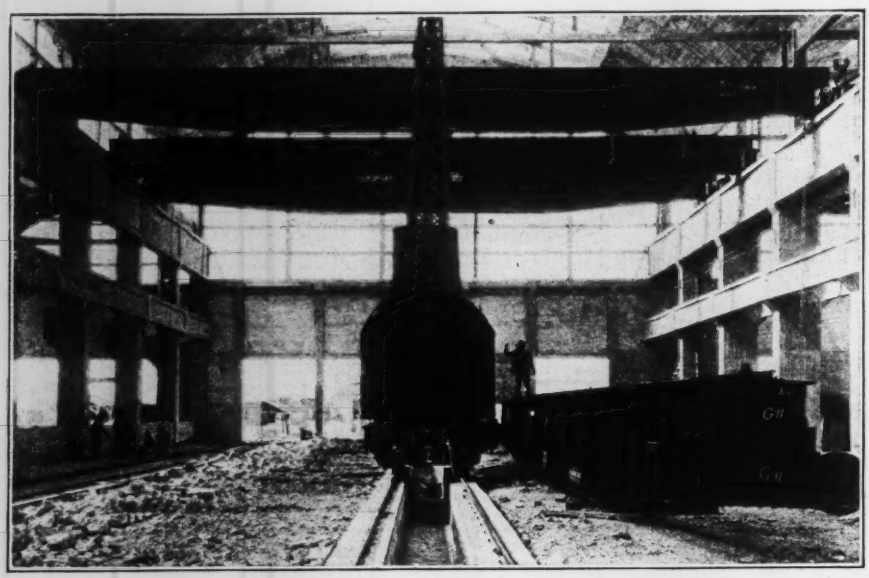


FIG. 3. LOCOMOTIVE CRANE PLACING THE BIG OVERHEAD TRAVELING CRANES IN ONE OF THE TWO LOCOMOTIVE ERECTING SHOPS (Taken July 12.)

own force has served to train them in handling any sort of a job which they may be called upon to perform after returning to the headquarters of their original regiment. As to disadvantages, the men assigned to French shops have, of course, been working elbow to elbow with mechanics who, as far as the day's work is concerned, are accustomed to go at things in a much more leisurely manner than is common under American shop management. It is, however, somewhat early to form an opinion as to the extent of this influence on our working force. A big difference in working conditions is that all of our machinists are enlisted members of military units and under military control, while such conditions do not obtain in the French shops.

The problem involved in getting the shops equipped and in operation was explained to me at some length during a conversation with the general superintendent of motive power, a colonel of engineers who is in command of the railway shop regiment. According to the original schedule, the buildings were to have been completed Sept. 1, 1917, and fitted up with machine tools, small tools, air, steam and water lines and electric power. This work all was to have been done by the French, leaving nothing for our regiment but to recruit its ranks from skilled shop men and begin operation. Subsequent events have indicated the extreme optimism of this program. The bare shells of the buildings were not turned over to the American forces until April, and the shipping crisis delayed the delivery of machine tools from the United States.

When the inventory of equipment for the shops was made up and orders were placed before the regiment sailed, three phases were planned for the shipment of material: First, construction tools, equipment and wiring immediately needed, to be shipped Sept. 1, 1917; second, machine tools, to be shipped Oct. 1, 1917; third, materials and supplies, to be shipped Nov. 1, 1917. It will give a fairly good indication of the difficulties our men faced to state that no machine tools had been delivered to the site on Apr. 1 of this year. By June, 20% of the machine tools had arrived, but, beginning with July, deliveries have been speeding up, and equipment is now being received in large quantities. These conditions are cited not by way of criticism, for delays have been inevitable, but rather to convey to our engineers in the states what the building up of our shipping tonnage actually means in the progress of our engineering work over here.

The first work done at the shops was on general engineering supplies, including the erecting and repair of pile-drivers, cranes and steam shovels. By June 1, however, track had been laid in the erecting shop and work was begun on placing the big overhead cranes shown in Fig. 3. By July 1, with some of the cranes in place, work was started on locomotive repairs.

On July 27 thirteen locomotives, all French, were in the shops for repair. The wide variety in the design of these machines is a complicating factor in the repair work. Nothing approaching standardization

FIG. 4. ONE BAY OF THE MACHINE SHOP SHOWING OVERHEAD CRANES IN PLACE AND MACHINE TOOL INSTALLATION PROGRESSING

exists, and many parts are not interchangeable. For example, the colonel of the shop regiment told me that there were 37 different types of Belgian locomotives operating on French roads, and of these our own shops have already handled repairs on 15 types. The central shops expect to receive for repair and over-

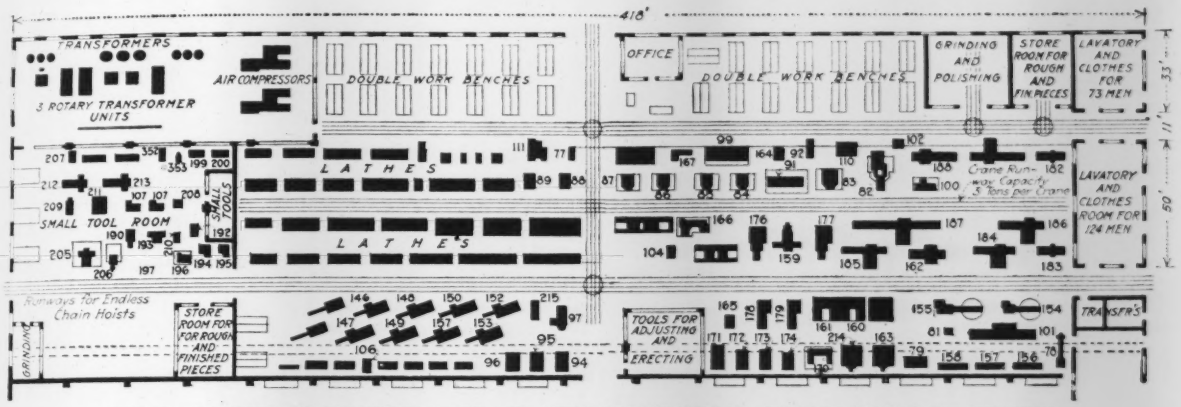


FIG. 5. LAYOUT OF MACHINE SHOP OF AMERICAN RAIROAD REPAIR SHOPS IN FRANCE

hauling not only all United States equipment but a certain number of locomotives from such important French railroads as the P-L-M, the Paris-Orléans, the Nord, the Est, and possibly the Etat. Our own rolling stock, being standardized, will be handled far more easily and quickly in the shops than the wide variety of European machines in service.

At the end of July the American operating force at the shops numbered about 800, and it was expected that the rolls for August would show a total of about 1500 men, for, with the buildings finished and the machine-tool installation progressing at a rapid rate, the policy is to call back to their own regiment, for work under the supervision of American officers, the details of men which had been assigned to duty in various French railway shops.

The thing to keep in mind in attempting to visualize the work which has been done at the central shops is the fact that practically everything, from small tools to big turret lathes, rolls and planers, has had to reach the job after a trip of more than 3000 miles. With the tremendous tonnage which is being delivered at our base ports here and handled by the various railway lines, it is no simple matter to have a big tool unit, parts must be packed and shipped in separate crates. If these all arrive at one time, well and good. If they do not—and such cases are not uncommon—the work of installing that particular machine tool must be held up, for it is practically impossible to duplicate missing parts over here.

Every American manufacturer, of course, is trying to help the work here in France in every possible way. Let him therefore, pay particular attention to two matters connected with the shipment of machine tools: First, take rigid precautions in inspection during crating to see that not a single part necessary for the operation of the machine is missing, since replacements take months, not days; second, insist upon receiving accurate directions as to the marking of crates to insure prompt arrival at their proper destination in France. When such directions are received, follow them to the minutest detail. It is a big place, over here, and we have scores of shops where machine tools are being installed. Unless a package is started out on its transatlantic journey *complete in all parts and properly labelled*, all sorts of confusion and trouble result on this side. A crate stencilled with some such generality as "American Army, France" may arrive

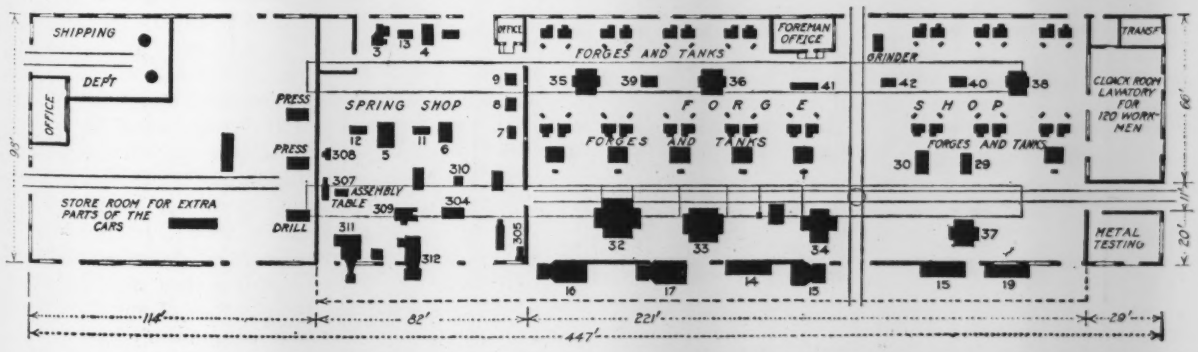


FIG. 6. LAYOUT OF THE FORGE AND SPRING SHOPS

here, but what will become of it after that only some of our stevedores may know for a while and promptly forget. When so many important things are demanding the best efforts of our engineers the pastime of organizing searching parties to ferret out missing equipment is one which is not popular over here.

All of the machine tools at the new railway repair shops, as well as the big overhead cranes, have individual electric-motor drives. The type of building constructed as shown in Fig. 4, was one ill adapted to the use of shafting and pulleys, on account of the height of the roof. Then, too, a big electric central-station development which the American Expeditionary Forces are completing at a distance of not many miles, makes available by means of a newly-built transmission line sufficient electric power for running the plant. Pending the delivery of this power, however, a temporary plant of steam-driven electric generator units was erected at one end of the shops and has been in service for some time.

A great deal of difficulty has been experienced in obtaining flooring material for the shops. Lumber is hard to get, but this difficulty is being met by employing for the flooring wood obtained from the packing cases in which the machine tools were shipped.

As to the layout of the shops, Fig. 5 shows the location of the various machine tools in the machine shop, while Fig. 6 is a plan of the forge and spring shop. There have been a few changes from the original plans, due to the nonarrival of certain machines and the receipt of others different in size from those expected. The scheme of individual electric drive for each unit, however, offers a considerable amount of flexibility in locating the machine tools, and changes from one place to another have not involved serious difficulty.

Erection Experiences at the Sciotoville Bridge

Machines Used Found Efficient—Adjustment of Bridge Easy—Deflections Agreed With Computed Values—Last of Three Articles on the Field Work

By Clyde B. Pyle
Manager of Erection, McClintic-Marshall Co., Pittsburgh

SUCCESS in erecting the Ohio River bridge at Sciotoville brought with it a number of experiences having application to large bridge work, especially continuous-span construction. On account of the magnitude of the work—the structure has two spans of 775 ft. each, continuous over the middle pier, with riveted connections throughout—and the new problems which arose from connecting the members in strained condition to eliminate secondary stresses, some of the conclusions drawn from the erection may be useful to the engineering profession.

First, notice is due the fact that the suitability and good service of the erection machines were important factors in the success of the work. The sequence of operations, described in *Engineering News-Record* of Jan. 10, 1918, page 62, and Jan. 31, page 219, made rapid and smooth progress a vital matter. Any long interruption of the construction work might have exposed the bridge to risk of destruction by flood. That the machines chosen turned out to be highly reliable and efficient was a most important and gratifying experience.

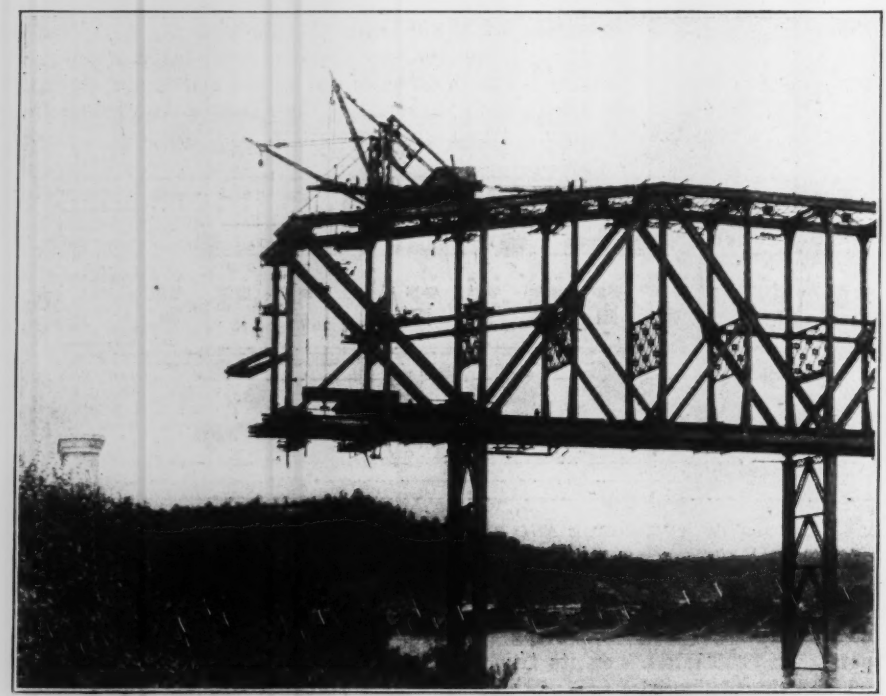


FIG. 1. TWO BOOMS ON CREEPER TRAVELER SPEEDED UP THE SCIOTOVILLE BRIDGE ERECTION

Different machines were used for the erection on falsework (Ohio span) and the cantilever work (Kentucky span), as previously described. Sketches of both machines are shown herewith (Figs. 2 and 5). The following briefly states the reasons which led to the choice of these particular devices.

Several points have to be considered in choosing bridge erection equipment: Simplicity, speed of operation, safety, low cost of construction and transportation,

and ease of setting up and getting ready for work. In addition, of course, the loads to be handled and the required reach must be taken into account. Machines that leave the supply tracks unobstructed and that do not have to run off the bridge frequently save time. In respect to all these requirements the machines selected are of high rank.

A gantry traveler running on tracks outside the bridge trusses was used for erecting the Ohio span on falsework because it is a simple tool to operate, it necessitated little or no additional falsework more than that required with any other erection device, it left both material tracks free, and it could erect both trusses simultaneously. A gantry traveler was already in stock, which furnished another motive for using it.

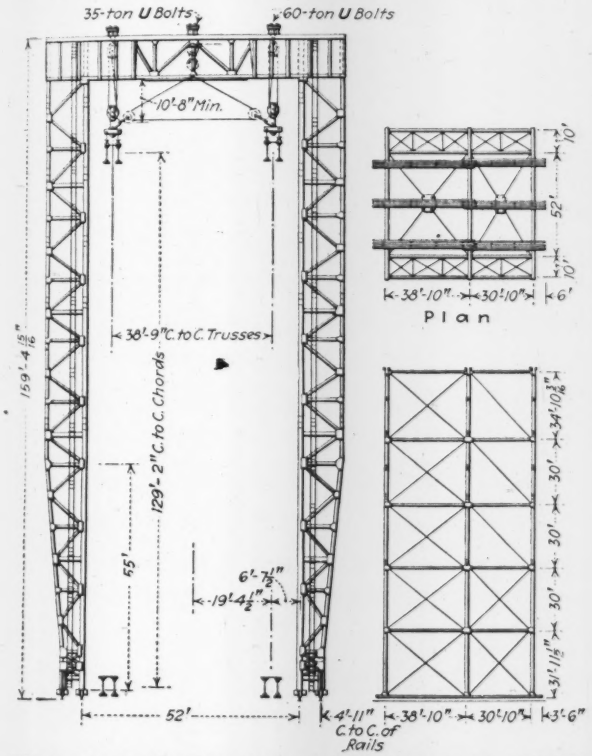


FIG. 2. GANTRY TRAVELER BUILT UP TO FULL HEIGHT FOR ERECTING TRUSSES OF OHIO SPAN

One objection to the gantry is the fact that its erection involves some time and trouble, but the advantages just cited outweigh this objection. The view in the adjoining column shows the temporary floor and the derrick used for raising the gantry.

Safety and simplicity of operation were the main reasons for adopting the top-chord or creeper traveler in the cantilever work.

A creeper with a single derrick boom had been used by the same contractors in erecting the Beaver Bridge (See *Engineering Record* of June 24, 1911, p. 704). While that machine did its work well, a large gain was made in the Sciotoville erection by providing two booms. The added weight was not great, and the speed of erection was doubled—an important matter because of ice and flood danger. Compared with the Beaver creeper, a much simpler structural design was possible, because the Sciotoville bridge has a stiff top chord and because

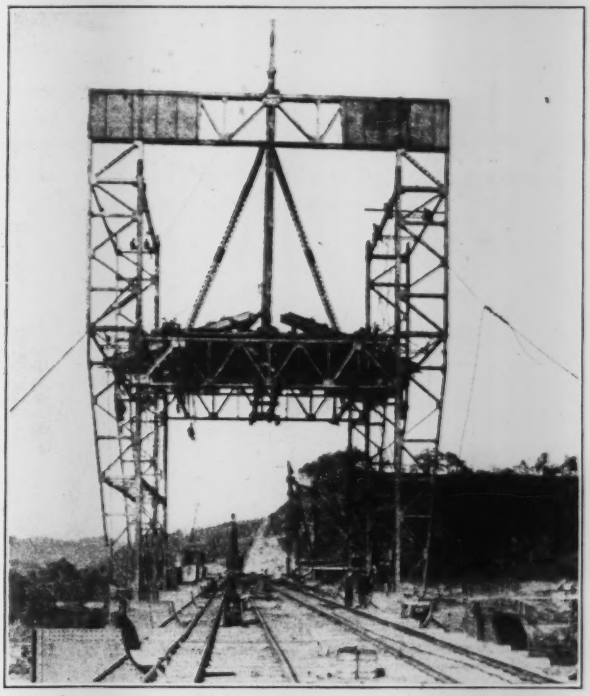
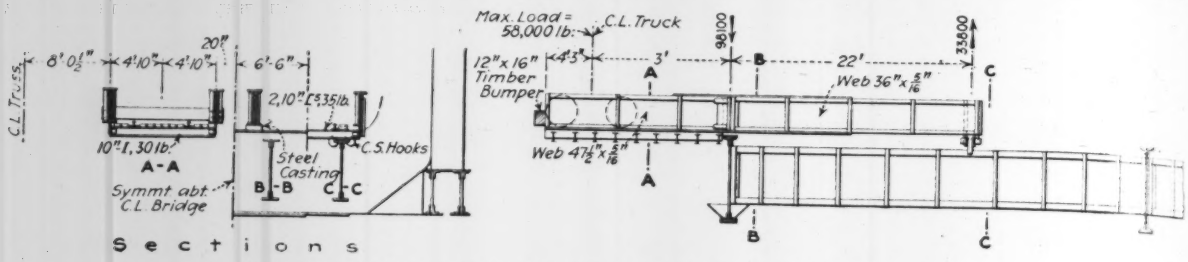


FIG. 3. STIFF-LEG DERRICK ON TEMPORARY FLOOR RAISING GANTRY TO FULL HEIGHT

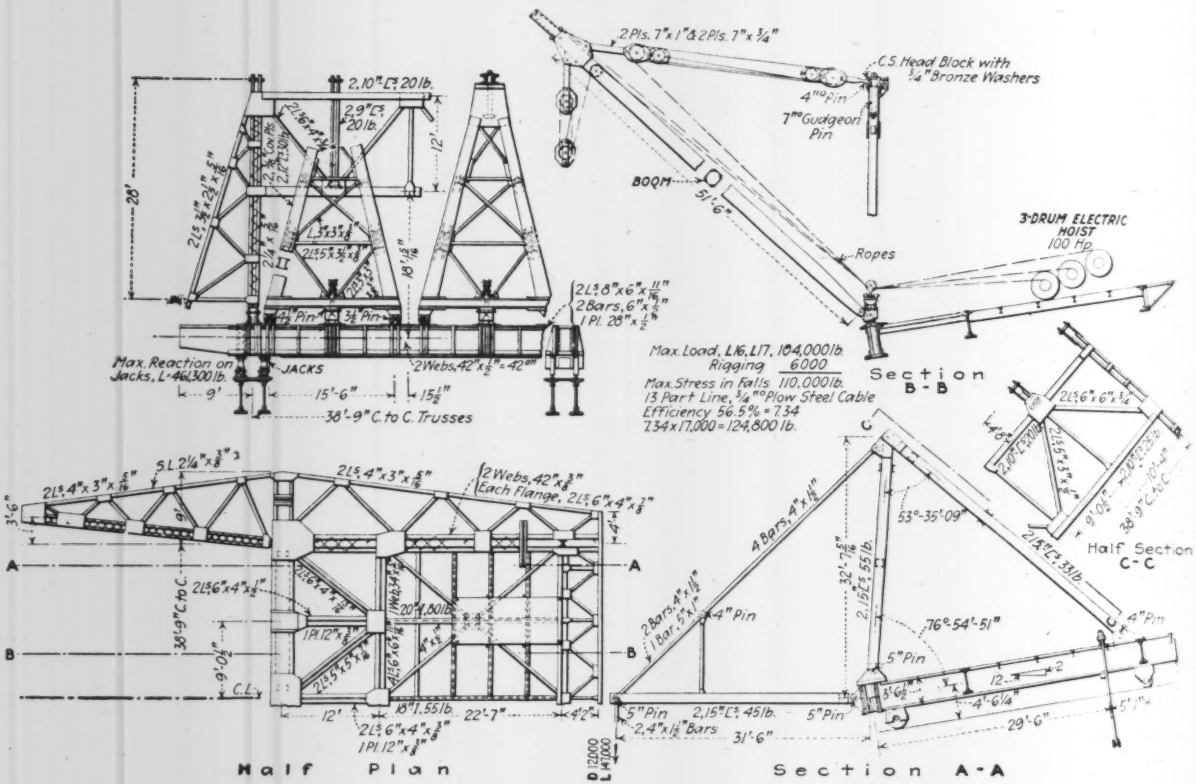
only one slope of chord has to be provided for, in addition to the horizontal; at Beaver the top chord consists of eye-bars and has several slopes.

The outriggers of the Sciotoville creeper were used to support scaffolding. This facilitated work materially. A large float under the bottom chord, suspended from

FIG. 4 TIMBER FALSEWORK ASSEMBLED IN PANELS HALF THE WIDTH OF ONE TOWER



Jigger Bridge for Material Cars Cantilevered Over Forward Floor-beam



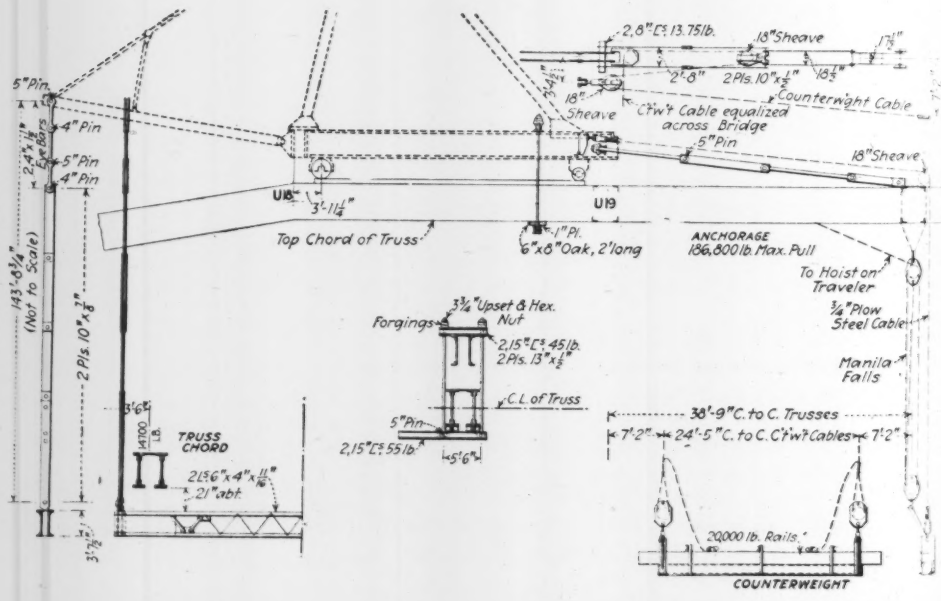


FIG. 5. TWO-BOOM CREEPER TRAVELER HANDLED MEMBERS OF BOTH TRUSSES; ADJUSTABLE PEAK CONNECTION TO SUIT HORIZONTAL AND INCLINED CHORD; MATERIAL BROUGHT OUT ON JIGGER BRIDGE; SUPPORT FOR JACKING UP TRUSS MEMBERS SUSPENDED FROM OUTRIGGERS OF TRAVELER; REAR OF TRAVELER ANCHORED AND COUNTERWEIGHTED.

these outriggers, gave the riveting gangs easy access to the bottom-chord splices and laterals. Smaller scaffolds similarly supported were used for the top-chord riveting. These were in correct position for their service, in every panel.

Two portals were embodied in the traveler structure for lateral bracing. One of these was in a plane just back of the derrick masts or A-frames, while the other was in the plane of the backstays. These portals also served as trusses for taking the pull of the derrick A-frames and transferring it to the main triangles of the creeper frame on either side.

As the creeper had to work both on the sloping part of the top chord and on the horizontal, provision had to be made for keeping the A-frames vertical. This consisted of an adjustable link at the top of each A-frame, tying it back to the portals. Three pin-holes in the link made it equivalent to a long and a short link.

As explained in *Engineering News-Record* of Jan. 31, 1918, the stresses in a long continuous bridge are not greatly changed by slight variations in the elevations of the supports. Therefore, the use of this type of bridge is to be encouraged, since considerable metal is saved.

It is not necessary to leave a chord splice bolted for adjusting in case the end deflection is ot exactly equal to the computed amount, through the effects of inaccurate reaming done in the shop.

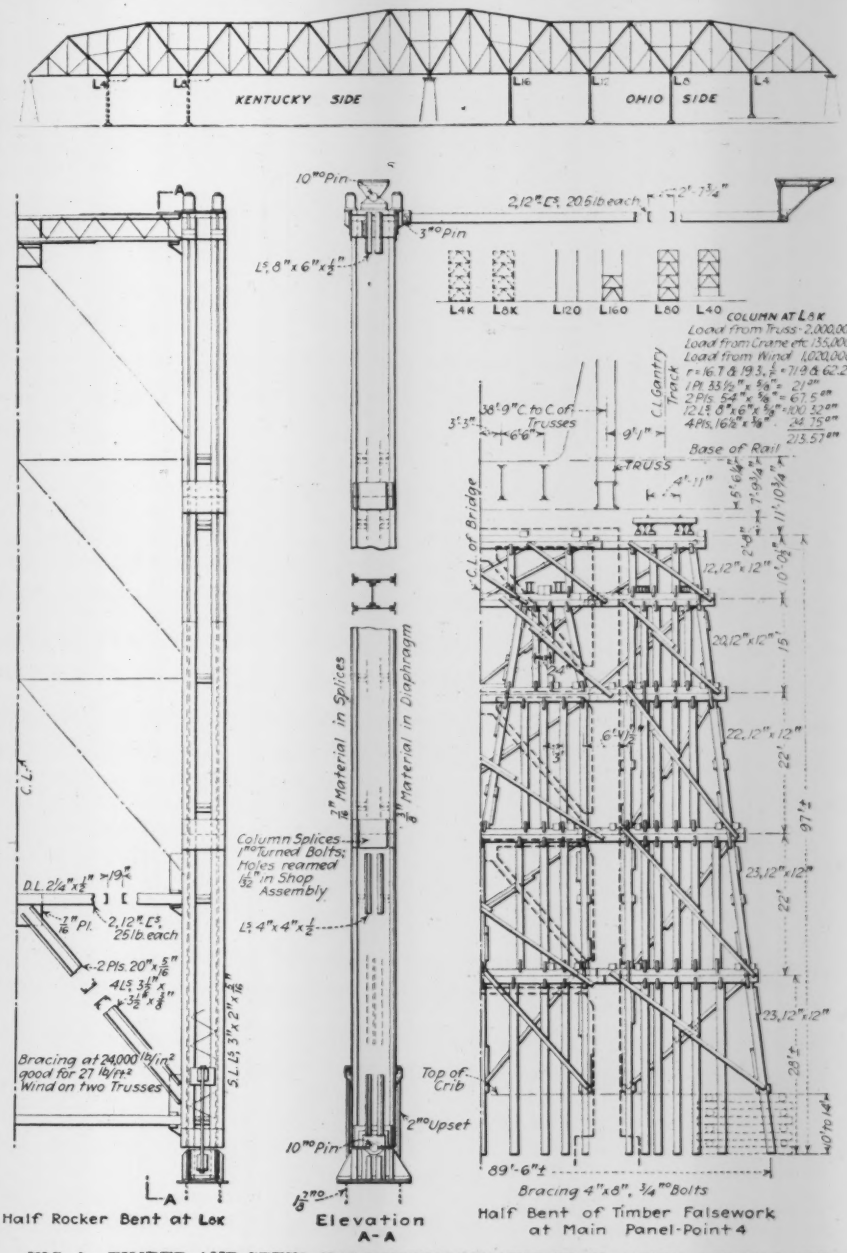

KENTUCKY SIDE
OHIO SIDE
Half Rocker Bent at L8K
Elevation A-A
Half Bent of Timber Falsework at Main Panel-Point 4
COLUMN AT L8K
Bracing at 24,000 lb/in² good for 27 lb/ft² Wind on two Trusses
Column Splices 1" Turned Bolts; Holes reamed 1/32" in Shop Assembly
Bracing 4"x8", 3/4" Bolts

FIG. 6. TIMBER AND STEEL FALSEWORK OF OHIO SPAN; STEEL BENTS LATER USED AS SUPPORTS OF KENTUCKY SPAN

Secondary stresses can be eliminated from the completed structure as was done in this riveted bridge. This requires reaming the trusses point by point instead of entirely fitting together. The extra work involves some expense and some loss of time in erection.

Computed deflections agree exactly with the actual. In the deflections of the Sciotoville bridge acting as a truss this was the case for computed values which considered the sections of members increased 10% on the average for the influence of details on deflection. Bending of individual members as simple beams, cantilever beams, or beams fixed and hinged at one or more points, corresponded exactly with computed values. In computing bending of individual members the effect of details was taken into account as accurately as possible for each member. Computations of deflections of the structure as a whole and of the bending of members while erecting them, which were made for the entire bridge, proved invaluable. Serious difficulty in the field was thereby entirely avoided.

If the two members meeting at a joint were not tangent, thereby making the holes at the ends of the splice and top and bottom of chord a little out of match (after a few pins had been driven near the center of the splice), some pins driven simultaneously in scattered holes brought the whole connection near enough to match for easy entrance of the rivets. However, even a large number of pins never seemed to bring all the holes to absolute match.

For driving long-grip 1⅛-in. or 1¼-in. rivets, 130 lb. of compressed air was necessary. With less pressure the heads were often not brought to perfect contact with the plate, or the holes were not perfectly filled, and loose rivets resulted in many cases.

Tapered-shank rivets more perfectly fill the hole, but the expense of driving is increased by having to use a hammer to enter the rivets and by the loss of rivets due to collars forming while entering those slightly too large near the head. However, the advisability of using them can hardly be questioned, for long-grip rivets.

Trouble From Loose Rivets

With splices made up of several thicknesses of steel all coated with red lead, many loose rivets resulted from the burning out of the red lead. On the large splices, where 1¼-in. rivets were driven continually one after the other, red lead often flowed out from between plates in a large stream. In some of the splices as many as 60% of the rivets where loose, due chiefly to the red lead burning out. Upon redriving the loose rivets as many as half the other rivets were loosened by the redriving. It seems as though this was due to red lead. No doubt the condition was aggravated by the fact that there were so many thin plates at a splice. In some cases all of the mattrial was 1 3/8-in. thick, with rivet grips as long as 7 or 8 in.; the material was made thin to enable it to be subpunched in the shop. If it had been thicker, with fewer surfaces, no doubt the percentage of rivets cut out would have been smaller. It would be interesting to know the results of using less red lead, or oil only, and perhaps an economy could be brought about without injury to the structures.

In reading loads on hydraulic jacks with pressure gages, accuracy can be secured only when all pipe connections are perfectly tight; small leaks rendered readings uncertain to the extent of 10 to 25% in some cases, while when there was no leakage repeated readings were identical.

Falsework settlement, the bottom end of the falsework resting on shale-rock river bottom, amounted to 3/16-in. per joint of bents. This takes into consideration every joint—between post and cap, between sill and cap, and between blocking.

Falsework designed for 25 tons steady load per 12 x 12-in. leg, or 37½ tons jacking load, carried 50 tons to 60 tons per leg in some cases for short periods with no sign of failure. The falsework was accurately plumb. The view, Fig. 3, shows its arrangement in integral panels. Fig. 6 gives some details.

Falsework bolts ⅞-in. in diameter are much more economical than ¾-in. bolts, because they do not bend so easily. The ¾-in. bolts were bent badly, to the extent of making it economical to scrap them in many cases, while most of the ⅞-in. bolts were used several times and were still in good condition.

The legs, caps and sills of the falsework were 12 x 12-in. timbers throughout. The diagonals in both directions were 4 x 8's, except in the lower stories, where 6 x 8's were used to provide against excessive cutting by ice. Each bent was built up of sections approximately 25 ft. square, which were erected in pairs.

The bridge was designed by Gustav Lindenthal, consulting engineer; O. H. Ammann was Mr. Lindenthal's principal assistant engineer and R. T. Robinson his resident engineer. It was built for the Chesapeake & Ohio Northern Ry. Co., Frank Trumbull, chairman of the board of directors; George W. Stevens, president, M. J. Caples, vice-president, and William Michel, chief engineer. It was fabricated and erected by the McClintic-Marshall Co., with Paul L. Wolfel, chief engineer; S. P. Mitchell, consulting enginer; E. A. Gibbs, manager of erection, and A. Toohey, superintendent of erection.

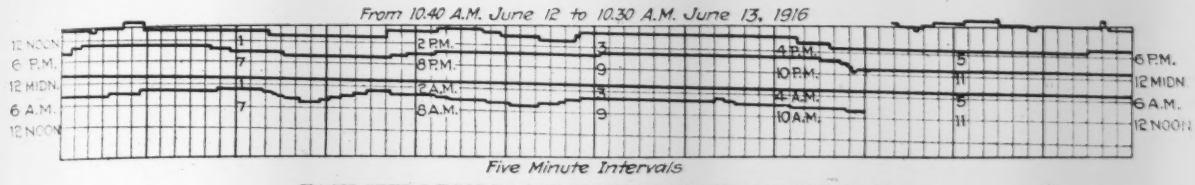
Water-Meter Flow Rates Recorded by Rain-Gage Mechanism

Studies at Hartford Water-Works Throw Light On Water Unaccounted For, Where All Services Are Metered

ADAPTATION of the recording mechanism of a rain gage to study the rates of flow through water meters was mentioned on p. 1074 of *Engineering News-Record*, of Dec. 12, 1918, in an abstract of a paper on "The Selection of Water Meters" by C. M. Saville, chief engineer of the Hartford, Conn., water-works, read before the New England Water-Works Association Nov. 13. Mr. Saville's description of the device, and some of the data obtained and conclusions drawn, follow:

Very little information seems to be available in regard to the rates of flow in service pipes and their duration, and no device was found on the market for getting an autographic record of the continuous use of water through service pipes and meters. Having had some experience with the Freiz automatic rainfall register, the writer suggested to one of his assistants the possibility of adapting the recording mechanism of this machine to the required purpose. After some experimentation, J. E. Garratt, office engineer, of the department's staff, made suitable electric connections between the meter-counter and a rain-gage recorder, and carried out in an able manner the field work of investigation. The apparatus is rather clumsy to take about, but it answers the purpose very well, and from its record some very interesting facts have been learned regarding the use and waste of water. The apparatus is carried in an 18 x 18 x 20-in. box and, including the box, weighs about 40 lb. The instrument is crude and probably not extremely accurate. Nevertheless, the records are submitted as throwing some light on the matter of water unaccounted for in systems where the services are very thoroughly metered.

The registering apparatus consists of an eight-day clock, with a driving mechanism for rotating a cylinder about 4 in. in diameter, around which the chart is wrapped in one fold. A very ingenious device, carrying the recording pen, is operated by electric contact at each tip of the bucket in the rain gage, or, in the case of a meter, at each revolution of a counter. The driving mechanism is so constructed that the drum makes an entire revolution every six hours, and the feed is so regulated that the pen describes on the rotating chart a spiral, the lines of which are about ¼ in. apart and thus avoid being superimposed. The rate of flow is indicated by the number of contacts registered by the

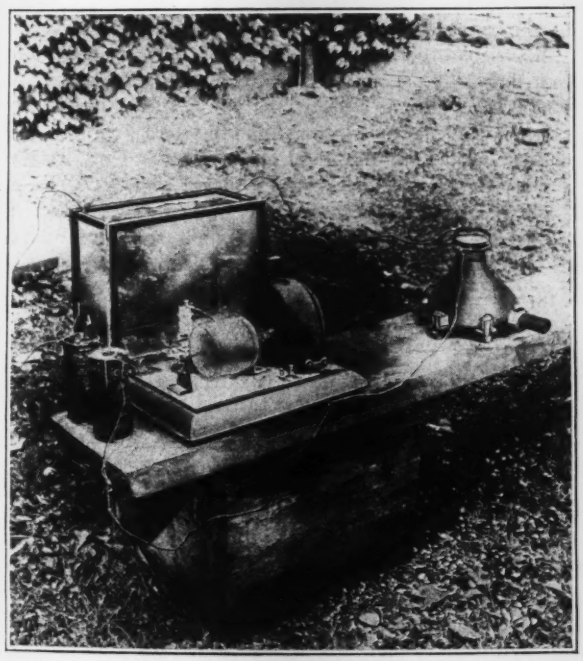


EACH STEP RECORDS ONE METER COUNTER REVOLUTION

From a ¾-inch water meter on a house in the best residence district of Hartford, generally occupied by six persons. Average water consumption for 1916, 56 gallons per capita per day. Water pressure, 70 pounds. Hot and cold water supplied to three laundry tubs, two sinks, four washstands and one bath tub. Cold water supplied to two tank water closets, two ¾-inch hose bibs in garage and one ¾-inch sill cock.

pen on the chart. Each of these contact marks is in the form of a step, the characteristic trace being five steps down and five steps up. From top to top of any series of steps there are 10 contacts. The chart is marked vertically in five-minute lines. At a glance, therefore, it is possible to read the number of steps or revolutions in any given period, and also to observe the time at which the water was drawn. One defect in the registering device is its inability to record sudden flows of less than 1 cu.ft., although the total quantity is registered.

On the accompanying chart [for a house in the best residence district of Hartford] the record began about 10:40 a.m., Tuesday, June 12. Preparations for luncheon are clearly shown. At 11:47 a draft of about 2.5 cu.ft. per minute occurred, and at 12 noon another draft of a similar amount. Throughout the afternoon there was some use up to about 3 p.m., then a period of comparative rest until about 6 p.m., when for two hours during the dinner period there was intermittent use. At about 10:25 a use of about 5 cu.ft. in 4 min.



RAIN-GAGE PEN ELECTRICALLY CONNECTED WITH WATER-METER COUNTER RECORDS RATE OF FLOW

indicates, possibly, the filling of a bath tub. From this time until 6:17 the next morning there was no flow, indicating either remarkably tight plumbing or a meter which failed to register small flows. From 7:10 to 8:50 a considerable use of water is noted, probably for bathing and for the family breakfast. The maximum use in the house on this day was 1.25 cu.ft. per minute.

The recording mechanism checked the meter reading of 68 cu.ft. for the 24 hours' use. For the week that this house was under observation, the consumption and maximum rates recorded in the table just below were shown.

	Consumption Cu.Ft.	Consumption Gals. per Cap.	Max. Rate per Min., Cu.Ft.	Duration of Max. Rate, Min.
Thursday, June 5	65	81	1.00	3.0
Friday, June 6	24	36	1.65	2.0
Saturday, June 7	46	58	1.33	1.5
Sunday, June 8	34	42	pen out of order	
Monday, June 9	52	64	2.20	2.0
Tuesday, June 10	43	53	1.30	2.5
Wednesday, June 11	68	85	1.00	2.0
Thursday, June 12	68	85	1.25	4.0

From detailed studies of the records for this house it appears that probably at least 11% of the water delivered was unrecorded by the meter, while for the entire 24 hours, except for 3 min. at about 10:43 a.m., the rate of draft was below 2 gal. per minute.

These records and those for an apartment house indicate that for most of the time the flow through the meter lies in the zone between the 90 and 98% accuracy ordinarily guaranteed for disk meters. If this condition is characteristic of meter performance, at least it offers an explanation of some of the hitherto unaccounted for water reported from fully metered water departments, ordinary rates appearing to occur on that portion of the scale where the registration is the least accurate in the meters used.

Proportion Concrete to Weigh 173 Pounds per Cubic Foot

In designing the concrete counterweight for the Cherry St. bascule bridge in Toronto, Ont., it was assumed that the concrete weighed 173 lb. per cubic foot. According to George T. Clark, designing engineer, Toronto Harbor Commission, experiments were made to determine the mixture of cement, sand, stone and iron ore that would just give this weight at the end of 90 days, at which time, it was considered, the chemical and physical changes would be complete. A number of 1-ft. cubical blocks were made of ingredients carefully weighed, including the water. It was found that to obtain the specified weight the stone and iron ore had to be mixed in the proportion of 1 to 3 by weight; also, that of the 6½ lb. of water used per cubic foot in mixing 4½ lb. were lost in drip and evaporation and 2 lb. were required for the crystallization. The ore was magnetite and it was mixed with screened gravel.

Highway Administration and Maintenance

Abstracts of papers read before the Joint Congress and meetings of the American Association of State Highway Officials and of the Highway Industries Association, Chicago, Dec. 9-12. General problems of supplying highway engineers, preparing for the reconstruction period, and laying out and maintaining highway systems are dealt with.

Engineers for Highway Construction

By J. H. Mullen
Deputy Commissioner of Highways, Minnesota

DISCUSSION of the subject, "Engineers for Highway Work," was intended to cover the means for taking care of engineering on road work under war conditions, as practically all of the larger highway engineering organizations have been greatly depleted in the past two years. This deficiency has in many cases, particularly in the Middle West, forced the closing down or abandonment of projects which could have proceeded otherwise. It was the duty of those not so fortunate as to have participated directly in the war to adjust themselves to the conditions and do their share in maintaining the progress and efficiency of the country.

That is what we were to discuss, but, fortunately, the war has ended. However, our problems now seem even greater.

Great Highway Development in Prospect

Evidently the country has become aroused to the need for highway improvement, and is willing to spend millions of dollars for that purpose, provided there is assurance that the work will be properly handled. The public, however, does not know how this should be done, and has but a very hazy idea of the need for scientific organization and expert supervision of highway improvement.

In discussing the qualifications of highway engineers, it is frequently stated that they require only from 10 to 25% of technical knowledge, and the remainder of common sense. The natural consequence of such a statement is to mislead the public and discredit the profession. Common sense is necessary, it is true, but common sense is fundamentally necessary for any other important work. The highway engineer must have a groundwork of engineering knowledge, acquired through years of practical experience and study, or by technical schooling. Without advanced technical training a man is greatly handicapped.

Actual training in this branch of the profession cannot, generally, be obtained in engineering colleges. We are now at the opening of a new transportation era, with a great volume of important highway work to be done, and the special training of a large number of engineers is called for. As the engineering colleges are not generally equipped to produce them, it falls upon state highway engineers to lend assistance in directing the work of the students, so that upon leaving college they will not have to serve a long apprenticeship before taking charge of work.

To perform efficiently the duties of a highway engineer requires not only technical qualifications, but also a knowledge of public affairs and administrative ability. There is a growing tendency, especially in Western states, to place upon the engineer the complete responsibility for highway management. He must direct engineering operations, study present and prospective tonnages and passenger movements on the highway, investigate availability of road materials, select economical types of bridges and other structures, and do a tremendous amount of special study.

Highway administration offers a great field for engineers, and the prospect of supplying the number necessary in the near future does not appear difficult, provided that there is recognition of service and proper compensation. The profession will attract engineers who have been in military service and who have previously had training and experience on railroads or similar work. These men have seen the roads of France, have had some experience in taking care of them, and will be anxious to get in touch with this development in their own country. However, this is a practical age, and if men of the proper kind are to be employed, if initiative is to be encouraged and efficiency prompted, there must be a material reward. If this is not provided, some of the highway departments which are now held together through interest in the work and loyalty to the service will not be able to hold experienced men.

The returning men will no doubt supply the immediate need, but it is the duty of state highway engineers to develop the younger men. This policy of coöperation is in line with the recommendation by Dr. Mann, in his excellent report for the Joint Committee on Engineering Education. [See *Engineering News-Record* of Oct. 24, p. 742.] An attempt has been made in Minnesota to follow such a policy during the past summer, and a number of subordinate positions in the highway department have been filled with university students.

Preparing for After We Have Won the War

By S. E. Bradt
Superintendent of Highways, Illinois State Highway Department

THIS topic was assigned to me when after-war conditions were largely a matter of speculation, and even today, with the war won, there is still but little indication of what these conditions are to be. In the war just closed, the men actually engaged are counted by millions, as compared with hundreds of thousands in any previous war. Money has been expended by billions, as compared with hundreds of millions heretofore. The disturbance of normal conditions has been in proportion to the men and money involved; hence, the task of readjustment will be correspondingly greater than that following previous wars.

Two phases of the problem concern highway engineers more directly. These are its probable influence upon wages, and our duty to assist in this crisis through

the employment of labor. Labor seeking employment undoubtedly presages, among other things, a readjustment of the wage scale. The indications are that this readjustment will be very gradual, and that we may not reach the pre-war basis for many years, if at all. While the conditions following the Civil War may not be any guide to the present situation, yet it is of interest to know that wages from 1865 to 1870 made a gradual increase, while at the same time commodity prices gradually decreased. Although we may not expect a rise in wages now, on account of the fact that they are already so high, still, with all the conditions taken into consideration, very little decline can be expected before the next harvest, at least.

With this situation confronting us, shall we assume the attitude of holding our money, awaiting a considerable decline in prices of labor and material, or shall we proceed to carry on a moderate amount of work with the idea of giving relief to our citizens, both through the improvement of the roads and the employment of those released from war work?

Personally, I am of the opinion that the immediate economic value of highway improvement is so great that we can afford to carry it on, so long as its cost is not out of line with the cost of labor and commodities at the time the work is done. While the cost of improving the roads is in many instances double, the cost of revenue-producing products, such as the crops, etc., is also double, and therefore taxes may be greatly increased. The fact is, the cost of roads today, measured not by dollars but by the things that we produce on our farms and in our factories, and with the selling price of labor, is no greater than it was three years ago.

Helping To Employ Surplus Labor

Again, from the standpoint of assisting in employment of labor during this crisis, it is undoubtedly the duty of the state to do what it can to tide over the coming period of uncertainty. This problem of the unemployed is not alone the problem of the United States, but of the world. Representative men of both Europe and America have emphasized the necessity of making public improvements to reduce this unemployment to a minimum. As highway officials, we should make all preparation possible for the early resumption of work. I suggest, however, that it would be advisable to limit the amount of work to what can be completed during the season, with a clause providing for cancellation of the contract, at the option of the state, if the work is not completed within the time specified.

From answers received to inquiries sent to all state highway departments, it appears that there will be available for highway work during the ensuing two years approximately $700,000,000. This would involve the employment of approximately 400,000 men each year for the working season, estimated at 180 days. Undoubtedly, the amount available and included in this sum will be materially increased by many of the states.

In connection with preparations for highway work, there are several conditions which should be corrected. First, the control of highway bond issues by the Capital Issues Committee should be removed, so that money can be made available without delay. Second, while prior to the time of utilities commissions and the Interstate Commerce Commission many states received concessions in freight rates on road-building material, these have been removed, and in many cases rates have been increased out of proportion to the advance in other commodities. A release should be given, especially during this emergency. Third, a great many highway engineers have been taken into the United States service, and the Government should be urged to release these men as rapidly as possible, so that they may resume their work.

If we are to have great development after this war, as we did after the Civil War, brought on by returning soldiers settling on farm lands, we must give them good roads. Having seen the excellent roads of France and Belgium and Italy, reaching through the smallest hamlet, they will not be satisfied unless they have roads connecting them with adjacent communities.

Laying Out, Marking and Maintaining a State Trunk Highway System

By Paul D. Sargent

Chief Engineer, State Highway Commission of Maine

(From a discussion of the paper read by A. R. Hirst and printed in Engineering News-Record of Dec. 12 and 19, pp. 1065 and 1128.

REGARDING the fundamental points of laying out a state highway system, so well brought out by Mr. Hirst in his presentation of the subject, I am sure that we can all agree. These points are specially valuable for states which are just undertaking the designation of a system of state trunk highways, together with their management.

In many of the states which undertook state highway work—say 15 to 20 years ago—no mention of trunk lines was made in the law. They were not popular, and each commission had to develop a system more or less piecemeal. This was especially true in most of the Eastern states. For example, the state-aid roads in Maine were originally designated by the county commissioner of each county, and this work was done without any particular reference to connecting the state-aid roads lying in the different towns. It was not until 1913 that the legislature created a highway commission and directed the laying out of an interlocking system of state highways. The system as laid out comprises 1300 miles, which is a fraction over 5% of the entire road mileage. It passes through 230 of a total of 521 cities, towns and unorganized plantations. Undoubtedly, from time to time slight additions may be made to this system, but I can hardly conceive that—in our state, at least—it will ever be necessary to include as much as 10% of our road mileage, as suggested by Mr. Hirst.

Marking the System

I feel hardly competent to discuss from personal experience the question of marking the system. I quite agree that it should be marked, but I must confess that up to within a year my personal position has been that no traveler, having fair general instructions, would ever leave an improved highway as long as he could see a good road ahead. However, properly marked highways are a very great convenience to travelers. An example of this is seen in the State of New Hampshire, which has an especially complete system of marking. Each highway has received a distinctive color, or combina-

tion of colors, and color bands are painted upon telegraph poles or trees on either side of each intersecting highway, and on the end posts of all guard rails.

Connecticut and Massachusetts also have a system of color-band marking as follows: North and south highways are marked with blue bands; east and west highways with red bands; and diagonal highways with yellow bands. The system outlined by Mr. Hirst is more complete than anything I am familiar with, and it seems to leave little to be desired in this respect.

Maintenance

Our experience in maintaining state highways has been similar to Wisconsin's, and I can agree with Mr. Hirst as to the desirability of a state immediately assuming the maintenance of the entire state system when laid out.

It has been our experience that most towns on our system have immediately lost interest in maintaining any section of road which has been designated, on the ground that the state will eventually build and maintain it. This condition has proved to be a very serious one for the traveling public, and upon the request of the highway commission permission was granted by the legislature to take over the entire maintenance of both improved and unimproved roads.

From Mr. Hirst's paper, I understand that the maintenance work of Wisconsin is actually done by the road forces of the various local communities, under the direction of the State Highway Commission. From an experience of two years in attempting to get maintenance done this way, I would say that I consider the method very unsatisfactory. As our system of improved roads was more or less disconnected, it seemed difficult to maintain it with patrolmen, and consequently arrangements were made with municipal officers and road commissioners in each town to do whatever work was laid out for them by the supervisors of the State Highway Department. The work was inspected from time to time, but we had difficulty in getting it done when we wanted it, and in the proper manner. In fact, it was found that some of the money was never expended on the roads where intended, but on entirely different roads.

As a result of the above experience, the legislature directed that all cities and towns coöperate with the highway commission for the maintenance of all the improved roads, and should themselves maintain the unimproved roads.

This work has been carried on for three years by the patrol method, the state having entire charge of the work. The patrolmen are hired from a list recommended by the local officials after the men have been interviewed by the state supervisor. Each spring they receive a complete set of instructions, and are visited as often as once in two weeks by one of our supervisors.

In 1916 patrolmen were paid $75 per month. For this they furnished one horse weighing not less than 1200 lb., a drop-axle wagon and the necessary hand tools, and a drag built for one horse. During the present season we started in paying patrolmen with one horse 44c. per hour, and with two horses 55c. per hour. On Sept. 1 we increased the rates to the following amounts: 50c. per hour for a man with one horse; 60c. per hour for a man with two horses. Due to abnormal labor conditions prevailing, and to stabilize our patrol force, we made an agreement with every patrolman when we hired him that we would pay him only 95% of his wages each month. The remaining 5% was to be held back until the end of the season and paid if he remained. If a man was discharged on account of unsatisfactory work, he was not to receive this 5%. This method has worked very satisfactorily. The total expenditure for maintenance in 1916 averaged $77.43 per mile; for 1917, $117.19 per mile; and rough figuring indicates that this year, due to high prices, it will be $157 per mile.

Use of Motor Trucks

Noting that Mr. Hirst does not favor the employment of trucks on patrol maintenance, I desire to refer to our experience in this line. During the season of 1918 we have had four one-ton trucks in patrol service. These trucks have replaced from two to four horses used under the old scheme; in other words, we have combined two, three or four patrol sections and have employed a truck driver with two to three helpers. Our observation is that these sections of road have been better cared for than in any previous season, and we plan to operate the trucks another year. However, one-ton trucks are not heavy enough for dragging, and when it has been necessary to drag the shoulders we have had to employ teams.

A comparison of the cost of patrol maintenance by trucks and by horses may be interesting. On one of our state highways, 35 miles in length, it cost $10,711.77 to maintain it by the man-and-horse patrol system. During 1918 the cost, including an allowance of $2 per day for depreciation of the truck, was $8,098.01, or a saving of $2500. On a 34-mile section it was, in 1917, $4,392.38; in 1918, $2,704.76, or a saving of $1700. On a 20-mile strip of road there was an increase from $3,599.65 to $3,806.17, but it is fair to state that in this section there was a piece of road 1.7 miles long which was entirely constructed.

Utilizing More Mechanical Devices in Highway Work

By Frank F. Rogers
State Highway Commissioner of Michigan

During the past year, and in spite of adverse conditions due to the war, there has been so much good-roads sentiment in Michigan that it would have been impossible to shut down road building entirely. In fact, there never was so much money available for road-building purposes before. While these peculiar conditions existed and there was nothing startling in the way of the use of new kinds of equipment, still, there were some labor-saving mechanical devices used which seem worthy of note.

Some of the commoner devices, such as steam shovels, have been used quite extensively in road grading. The steam shovels have been used not only where the excavation is heavy, but sometimes on rather light work, where not more than a foot, or less, had to be scraped off from the old grade. Mechanical power for delivering materials to the roads has been used quite exten-

sively and ranges from the motor truck to the industrial railway. In fact, it may be said that mechanical hauling has very largely displaced team hauling on the Michigan roads.

In grading operations, tractors have largely superseded horsepower. Tractors were not only used for hauling graders, but ditching has been successfully done by using flat-board scrapers. A scraper is hitched to each end of the tractor, which has a very short wheel base. The tractor is then moved across the road alternately forward and backward, but with a slight angle to the center line of the road, so as to move along the road the width of the scraper with each move. As the tractor moves in this diagonal fashion ahead, the scraper hitched to the rear end draws a full load up onto the road, while the scraper hitched to the front end is backed to the ditch, and vice versa. This way of using the tractor is said to be much more rapid than the work of two teams. Ditching has also been done with the same type of scraper, by using a small gasoline reversible hoist placed on a truck stationed in the center of the road. A scraper is hitched to each of the two ends of a cable which run off opposite ends of the drum.

One report speaks of a tractor being used for dragging, but expresses doubt as to the advisability of using it where there is a crust on the road, as in sand-clay construction, because the lugs on the wheels do possibly as much damage as the dragging does good.

Car camps on wheels, with two units in each outfit, one a sleeping unit and the other a kitchen, have been used in one county. These, with two tractors, have maintained a road 70 miles in length in better condition than ever before, and at a saving in cost equal to the cost of the tractors. Great economy was effected by being able to move camp each day if necessary, thus keeping the crew adjacent to the work. This method was used in Gogebic County by the county engineer, C. F. Winkler.

A roller of novel design, for finishing concrete roads, is reported on by J. W. White, county engineer of Monroe County. It is built to roll lengthwise of the road, and its surface is concaved to give the required crown. The first roller built was of wood, was 3 ft. in diameter and 15½ ft. long and weighed 2200 lb. This had a tendency to produce a wavy surface, so one of 5-ft. diameter, weighing about 2000 lb., was built of steel. The latter cost about $400. This rolling compresses the concrete slab between ¼ and ⅜ in., squeezing out the water and closing the voids. Ten miles of road have been built thus, with perfect satisfaction.

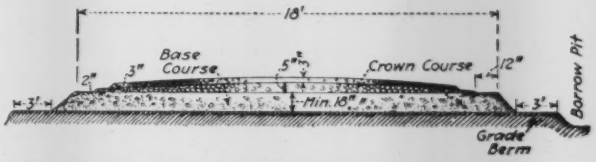
Besides the above, portable sand- and gravel-washing plants, special motor trucks equipped with spreading apparatus for surfacing, complete central distribution plants with proportioning apparatus, and an industrial railway to deliver the material to the mixer, have been used.

Constructing Gravel Road Across Salt Lake Desert

Lincoln Highway Has 17-Mile Tangent on Cut-Off Which Saves 50 Miles of Travel—Grading With Caterpillar Equipment

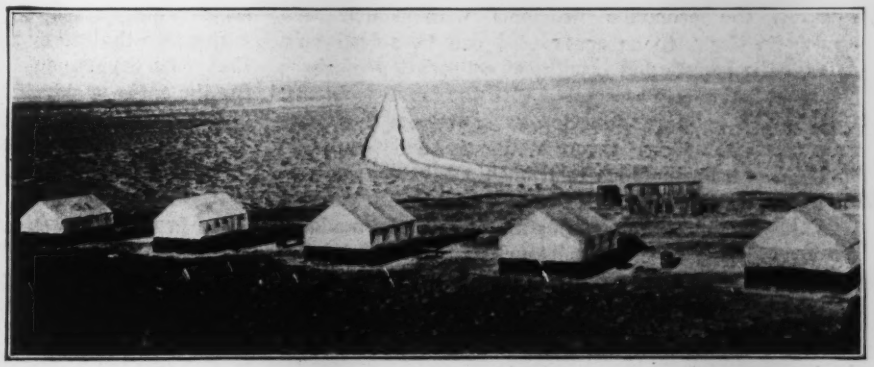
CONSTRUCTION of an 18-mile stretch of gravel road having a 17-mile tangent is included in the 142-mile cut-off on the Lincoln Highway in Utah. This cut-off shortens by about 50 miles the distance to be traveled on the highway. The route followed by the highway passes through Coe Cañon and will cross a spur of Granite Mountain, which juts out into the desert. Another section will cross a mountain range, where the present trail through Johnson Pass will be improved and widened.

This new road is built with a width of 18-ft. at the top of a base course which has a minimum thickness of 18 in. and a maximum of about 5 ft. Desert soil is used for the base, and is covered with a 5-in. course of gravel upon which is a second or wearing course of gravel 3 in. thick. The details are shown by the cross-section. The culverts are shallow wood boxes 6 or 12 ft. wide and 12 in. high, and are laid on the natural surface and covered with the roadway fill. In constructing the fill, the ground is broken by gang plows of the blade type, and elevating graders working on either side of the road build up the base course. This is then dressed to shape by road graders. Caterpillar tractors of 40 hp. and 70 hp. haul the plows and graders, respectively. After the roadbed has been finished with a five-ton roller, the gravel is hauled and distributed by motor trucks having steel-tired wheels, which serve to pack and consolidate the material. Heavy



TYPICAL CROSS-SECTION OF ROAD ACROSS DESERT

rains softened the loose, silty soil to such an extent that it would not carry the weight of the road-building machines. To meet this emergency, the bearing surfaces



17-MILE TANGENT ON DESERT ROAD WITH CONSTRUCTION CAMP IN FOREGROUND

were widened by bolting pieces of heavy plank to the caterpillar tracks of the tractors and to the wheels of the graders. This was described in *Engineering News-Record* of Dec. 12, p. 1092.

On the desert section about nine miles of road had been completed early in November at a total cost of $56,166, or $6240 per mile. Work on the mountain pass section had only been commenced at that time. A

CATERPILLAR ROAD-GRADER AT WORK ON THE DESERT

force of 24 men was employed on the work, under charge of R. E. Dillree as superintendent, with a camp of large tents at Black Point. During the long summer days two shifts were worked, in order to expedite the work.

The new road is being built by the State Road Commission of Utah, a portion of the funds being provided by the Lincoln Highway Association. The construction is under the direction of Ira R. Browning, state road engineer, and G. F. McGonagle, state engineer.

Cost-Plus Contracts Great Lesson of War Construction

Three Important Tasks Confront Organized Contracting, Asserts General Marshall, Chief of Construction Division of the Army

THREE lessons of vital importance to organized contracting have come out of the experience of the United States in contracting for war construction. In his address at the Chicago convention of the Associated General Contractors of America, Brig. Gen. R. C. Marshall, Jr., chief of the construction division of the War Department, presented these lessons in the following words:

"First, the economic problems with which this country is about to be confronted can be solved only through the hearty and intelligent coöperation of those men most intimately associated with the labor problems. This is the primary function of this new organization—the cementing, through honest and equitable dealings, of a harmonious relationship between the contractors and the labor of the country. Readjustments must happen, but these readjustments must be made in the development of the reconstruction period and must not be revolutionary in their character.

"The next great lesson is that bearing upon the relationship between the contractor and the owner. No contractor should be called upon or permitted to undertake the performance of any contract such that within the four corners of the paper upon which it appears, is, or may be, written the financial bankruptcy of the contractor. It is unjust, it is inequitable, it is uneconomic.

"The great lesson of this war on the subject of the relationship between the contractor and the owner is the cost-plus contract. This represents the only equitable basis upon which a contractor may perform constructive and economic services for the owner. It is the only form of contract which affords protection to both parties. All of the energies, the thought and the experience of this country within its own continental lines during the past year and one-half of this world struggle shall have been in vain unless out of it shall grow, as a permanent institution, solidifying the economic relationship between the contractor and the owner, the cost-plus contract.

"There is one other thought. This association should undertake to encourage coördination between contractors, engineers and architects, through which coördination not only will friendly relations be encouraged, but a united effort will be made to attain the unification of the energies of all of these three groups, each of which is equally interested in the one problem of construction.

"An effort should be made by this association for direct contact with associations of engineers and architects, by which contact there may be afforded a medium of exchange of ideas, to the end that there will be a perfect harmony of action on all of these mutual problems."

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Why Offer Such Low Government Salaries?

Sir—Recently I received a typical civil service announcement from the Navy Department asking for draftsmen of different grades, the salaries ranging from $4 per day in Grade 1 to $6.88 and over in Grade 4. Practically only in Grade 1 are men accepted who are not graduates of schools of recognized standing. In addition to this, considerable practical experience is required.

It states that many vacancies now exist, and, further, that "the department is finding difficulty in obtaining for the rates of pay it has to offer men with the qualifications necessary to meet its requirements. As the need for ship draftsmen is pressing, qualified persons are urged to enter this examination."

It struck me that if the Government is having difficulty in finding men at the salaries offered, why are they not increased? That is the customary thing in other professions; why should the Government appeal to engineers' patriotism in a case like this, when the engineer has no chance to appeal to anyone's patriotism in meeting the high expenses caused by the war?

I think it is time that the engineering profession got

together to require just compensation for service. During the war the American engineers have shown ability to adapt themselves to extraordinary conditions and make good. The profession is probably now recognized as of much greater importance in the world's affairs than ever before. I believe the time has come to use this recognition to obtain greater recompense. By organization, other workers have increased the recompense for their services tremendously, while professional men have stood still. I believe it is not below the dignity of the profession to bring pressure to bear upon both Government and private organizations for greater recognition in the form of higher salaries.

State College, N. M. A. F. BARNES,
Dean of Engineering, New Mexico College of Agriculture and Mechanic Arts.

Equivalent Uniform Loads for Maximum Stresses Discussed

Sir—I have read with great interest D. B. Steinman's article in your issue of Aug. 1, page 231. I believe, however, that cases frequently occur in statical indeterminate structures in which it is difficult to apply the results directly.

It will, for instance, be difficult to apply Dr. Steinman's values in cases of reversal of live-load stress where the influence area for the larger stress is shorter than the influence area for the smaller stress. To be consistent, the same train length with engines headed the same way should be used for both influence areas, the reversal of stress being understood to occur during the passage of the live load.

I wish, therefore, to mention a somewhat different method for reading influence lines, for engine and train load, which may be applied in cases where Dr. Steinman's equivalent values cannot be directly applied. This method is to substitute a uniform loading equivalent to the engines only, followed by the specified uniform train load. This equivalent loading will answer the purpose for any form of the influence line, whether curved or triangular, and for any length of loading longer than about twice the length of the engines. This form of equivalent loading will further take care of any lack of symmetry of a segmental influence line, which lack of symmetry frequently occurs to a pronounced extent; for instance, for the bottom chord members nearer the center of a spandrel-braced two-hinged arch.

The position of loading which gives maximum stress is found quickly by applying a transparent scale made as follows: On the ordinate to a horizontal line, plot 1 unit = the intensity of equivalent engine load; for instance, 1 unit = 8500 lb. On another ordinate at a distance from the first equal to the length of the engines —for instance, 100 ft.—plot 1 unit = the difference between engine intensity and train-load intensity; for instance, 1 unit = 8500 — 6500 = 2000 lb. The position of loading which gives the same reading of the subdivisions of the two scales, simultaneously, is the position which gives maximum stress; these values correspond approximately to E 65 loading.

An equivalent loading of this character can be made to give readings with a deviation of less than ½% average and less than 1% maximum from exact reading with wheel loads; for lengths shorter than about 200 ft. an exact reading with wheel loads should be used.

The proposed method may, however, be adopted for shorter spans by using one uniform load intensity for the engines and another load intensity for the tenders. In the case of investigating a bridge for one heavy engine followed by train load, there should be three ordinates on the scale; one ordinate with unit equal to the engine load, one ordinate with unit equal to the difference between the engine and the tender load, and one ordinate with unit equal to the difference between the tender and the train load. The maximum position is found when the reading on the engine ordinate is equal to the sum of the readings on the two other ordinates.

It may be added that, for the lower half of verticals in K trusses and for the bottom chord in Petit trusses a uniform load as here proposed would fulfill the condition better than Dr. Steinman's loading, on account of the broken shape of the influence lines.

Detroit, Mich. C. L. CHRISTENSEN,
Assistant Bridge Engineer, Niagara River Bridge, Michigan Central R.R. Company.

[The foregoing letter was submitted to Dr. Steinman, who made the following reply.—EDITOR.]

Sir—The method of finding live-load stresses submitted by Mr. Christensen should be of interest to bridge computers. The principle applied therein for fixing the position of a chain of uniform loads to produce maximum stress is capable of a strikingly simple demonstration which shows the criterion to be correct for any form of influence diagram. The only limitations of the method arise from the evident inaccuracy of substituting a fixed average uniform load for the wheel concentrations of the locomotive loading.

If Mr. Christensen's method has any practical usefulness, it is only for long-span structures or influence diagrams exceeding 200 ft. in length. For shorter influence lines, the method cannot be used without further subdivision of the train into separate uniform loads for engines and tenders, respectively; and when this is done the increased complication of applying the criterion and the extra labor of evaluating the load-area products destroy whatever time-saving advantage this method may have over the ordinary and more reliable procedure of moving-wheel concentrations.

Even for longer spans, the proposed method cannot be relied upon for accurate results. Its application to some simple examples selected at random by the writer yielded errors ranging from 2 to 5%. With the writer's "Chart of Equivalent Uniform Loads" (*Engineering News* of Apr. 22, 1915), the same stresses are obtained, correct within 0.1% and with an expenditure of but a small fraction of the time and effort.

Mr. Christensen's method requires an accurate scale drawing of the influence lines, and involves the labor of first determining the load position for each stress, and the succeeding measurements and computations of load-area products multiply the opportunities for mistakes. In the writer's method, even a freehand sketch of the influence line can be dispensed with; the trouble of finding the load position is entirely eliminated; there is no scaling of ordinates or measurement of areas; and the entire operation is reduced to a single multiplication. Moreover, the method is applicable to all lengths

of span without modification, being just as simple and accurate for short influence lines as for long ones.

The foregoing observations would appear to exclude the proposed method of Mr. Christensen from consideration as practically advantageous with influence lines of any form shorter than 200 ft., or with rectilinear (triangular) influence diagrams of greater length. For curved influence lines exceeding 200 ft. in length, the wirter's "Chart of Equivalent Uniform Loads" gives the stresses within a fraction of one per cent. even without applying any correction for curvature. Consequently, there would appear to be no advantage in the new method over existing methods for any ordinary case of influence lines, either rectilinear or curved, short span or long.

Mr. Christensen cites some special cases which he regards as limitations of the writer's method of Equivalent Uniform Loads. The first of these is a rather farfetched case arising from an unusual specification relating to reversing stresses. Even in such a case, the error arising from the use of the writer's method without modification would be small and on the side of safety; and considering the uncertain and debatable nature of all provisions for reversal of stresses, there would appear to be little need for over-nice distinctions in such stress calculations.

With unsymmetrical curved influence lines and other forms of peculiarly irregular shape, it is questionable whether the proposed method would give better results than the writer's. In these exceptional cases the writer would prefer to use the old method of moving wheel concentrations; if these are applied with a transparent scale (as described by the writer in *Engineering Record* of Apr. 24, 1915) the exact stress is quickly obtained by the simple addition of the ordinate readings, and the time required will be less than in Mr. Christensen's method of products of average loads and areas.

New York. D. B. STEINMAN.

Luxury or Necessity?

Sir—Referring to the editorial, entitled "Luxury or Necessity?" in your issue of Oct. 31, I am gratified to note your appreciation of the fact that Government control has, in the matter which you discuss, accorded recognition to the necessity for maintaining corporate organizations of the railroad companies during the period of Federal control. I cannot help regretting, however, that you did not acquaint yourself with actual circumstances before venturing upon the subsequent observations contained in the editorial and relating to the recall of an Army officer to become engineer of a railroad corporation. There can, I assume, be no question that the editorial has reference to the Pennsylvania R.R. Co., and to the release from the service of the United States Army of Col. H. C. Booz to become our corporate engineer. At any rate, "the coat fits," and I am not aware of the existence of any similar case which you might have in mind.

What hurts in your article, by reason of its injustice, is the reference that, in asking for the release of Colonel Booz, our company acted selfishly and placed corporate interests before patriotic considerations. As this was by no means the case, I will endeavor to make clear what the exact facts were.

In September, 1917, Colonel Booz, then assistant chief engineer of our company, was granted leave of absence to serve in France on the staff of Gen. W. W. Atterbury, director general of transportation of the American Expeditionary Forces, and operating vice-president of this company. Colonel Booz was appointed engineer of construction under General Atterbury, and in this capacity had charge of planning and constructing the wharves, docks, rail lines, and other new port and railroad facilities necessary for the entrance of the American Army into France and its maintenance there. He was abroad one year, and in that period perfected full plans for, and, in major part carried to actual completion, the work coming under his supervision. The uncompleted portion, prior to the initiation of steps looking to his return, had very largely been taken over by the regular Army engineering forces. In fact, during the course of the year, the railroad problem connected with the presence of the American troops in France changed from one of engineering construction to one of actual operation, so that the engineer taken from civil life to plan and start the work, and execute its principal portions, could be safely withdrawn without in any way affecting the carrying out of our country's war plans.

It seems pertinent to refer at this point to a fact which heretofore could not be published; namely, that with the return of Colonel Booz to this country steps were immediately taken to send to France an experienced transportation officer to serve on the staff of General Atterbury. The official selected, J. G. Rodgers, is a member of our corporate organization and assistant to the president of the company. He was formerly general superintendent of the northern division of the Pennsylvania R.R., and, on the entrance of this country into the war, was detailed to duty in Washington as one of the aides of the railroads' war board. Mr. Rodgers has been commissioned lieutenant colonel and is now on his way abroad to assume charge, as an operating expert, of the transportation facilities which Colonel Booz planned and largely carried to completion. Therefore, even on the man-for-man basis, the arrangements made by our company with the military authorities do not involve any diminution of railroad experts at the service of the Government.

Before any formal steps were taken to request the withdrawal of Colonel Booz, the military authorities here and abroad were consulted, and they were found entirely agreeable to the action contemplated. We would think the fact that the release of Colonel Booz would, of necessity, have to receive the approval of the War Department ought to be a sufficient guarantee that no interference with, or risk to, the military plans of the United States was involved, but we regret that you did not view the situation in that light.

You suggest that we might have sought a corporate engineer elsewhere, and I have no doubt that this was based upon the assumption that other trained civil engineers were available in the railroad organization. This, however, was not the case, as the entire civil engineering official staff of our company at home was taken over by the Railroad Administration, as a war emergency step, to assist in keeping the railroads in this country in operation for military purposes—a primary necessity to the successful conduct of the war abroad—and, at the

same time, to make possible the maintenance of an adequate service for the general public. Colonel Booz was, therefore, the only properly qualified man available, and in view of the advanced stage reached by the work under his charge, and the full assurance of the military authorities that the time had been reached when he could be released without detriment, we felt fully justified in taking a measure which is necessary for the protection of the stock and bond holders of this railroad system, who, it is well to bear in mind, have more than $1,750,000,000 worth of property at stake.

You threw in a remark to the effect that you were informed that the engineer in discussion was by no means anxious to be withdrawn from service abroad. This is entirely correct, and is in the highest degree creditable to Colonel Booz. It is, in fact, entirely natural in the case of a man who is still young and possesses spirit and patriotism. Nothing could be more in accord with human nature than a desire on his part to see the conclusion of the great events which he had been witnessing for a year, but such desire did not stand in the way of acquiescence in a call for performance of duty to his railroad corporation, after his duty to his country had been performed.

I might perhaps pass by the uncertainty created by the title "Luxury or Necessity?" but feel that it is probably better to deal with all matters fully. Our corporate organization consists of less than 200 officers and employees, and this very modest force must deal with all the extremely difficult and complicated accounting, legal and other matters arising out of the relations between the company and the Government, as well as protect the financial interests of stock and bond holders amounting, as I have stated, in the Pennsylvania System, to about $1,750,000,000. As contrasted with this corporate organization, it may be well to bear in mind that, in round figures, 260,000 officers and employees of this railroad system are now in the service of the Government.

The necessity for a corporate engineer may be judged from the fact that such an office is necessary under the terms of the standard clauses of the contract with the Government. These require, on the company's part, supervision of plans and estimates for, and of the actual carrying out of, all new construction work, the cost of which is to be borne by the corporation; also protection of the company against being charged with work for which it should not properly pay (i.e., pure war facilities), as well as inspection to assure the upholding of Pennsylvania R.R. standards in maintenance work, reconstruction of buildings, bridges, and other facilities during the period of Government control; and, in addition, supervision over maintenance and depreciation charges to operating expenses during Federal control. Mr. Booz will be in charge of this work for practically all the lines of the Pennsylvania System east of Pittsburgh and Erie, and *the new construction work alone, already planned and coming under his supervision, amounts to more than forty million dollars.*

May I close by briefly calling attention to the fact that this railroad system has still a representation in the Army of the United States of which we feel that we have just reason to be proud? Our vice-president in charge of operation is still the director general of transportation for the American Forces in France. We have also in France the president and operating head of the Cumberland Valley R.R., of which the Pennsylvania R.R. Co., is sole owner; the general manager of the Long Island R.R., of which our company is practically sole owner; the comptroller of the Pennsylvania R.R. Co., and many other of our most valued officials and employees. Altogether, considerably more than 20,000 Pennsylvania R.R. men are in active military service and many of them entered the army as volunteers before any draft law or selective service act was put in force, and when men of experience were badly needed, especially in making up railroad engineering regiments of the Army.

We particularly regret the inference in your editorial because our company and its men were among the very first to make heavy sacrifices toward winning the war, and the release of experienced officers and men beyond draft age added to the burdens and sacrifices necessary on the part of those who were left behind to carry on their work—a work just as necessary to the successful outcome of the war as has been that of the soldiers in the field.

A. J. COUNTY,
Vice-President in Charge of Accounting,
Pennsylvania Railroad Company.
Philadelphia.

Modified A. R. E. A. Impact Formula

Sir—I was much interested in the article on impact formulas in your issue of Nov. 21, and wish to add another formula that seems to agree with the A. R. E. A. tests fairly well and is somewhat more simple than some of those I have seen proposed. It is a modification of the Schneider formula, which I first incorporated in our specifications in 1908 previous to the publication of the A. R. E. A. test results. It is

$$S = \frac{300}{2L + 300} \text{ for main line}$$

$$\frac{150}{2L + 150} \text{ for spur tracks.}$$

This impact addition is used with 15,000 lb. per square inch working stress. It gives slightly heavier construction than the A. R. E. A. specifications for spans up to about 50 ft. and lighter beyond that, when the main-line formula is used. As we have a number of bridges on stamp-mill approaches, where the main-line formula would give excessive results, the spur-track formula was adopted to cover such cases.

F. L. BATCHELDER,
Chief Engineer, Copper Range Railroad Company.
Houghton, Mich.

Reduction in Cement Sack Loss Saves $25,000

Every empty cement sack in good condition returned to the cement mill brings 25c. On the Miami Valley flood-protection work enough cement will be used to bring the sack salvage credit to $500,000, providing there is no loss of sacks. In ordinary construction operations the sack loss is between five and ten per cent per 100 sacks received. A 5% loss on $500,000 is $25,000. This is the sum which will be saved if loss is reduced, by care, from ten sacks to five sacks per hundred.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Costs Are Not Trade Secrets to Be Concealed

CONTRACTORS as a whole keep cost records from the eyes of all but a few of their principal assistants. One contractor, known to the writer, has adopted the opposite plan. He opens his field-construction cost records to any man in his organization who is interested enough to ask to see them. He invites his foremen and machine operators to study these records, and takes pains to make the figures so plain that no one can fail to understand them. He goes even further in his cost-publicity practice; he bives to the engineer or architect who is supervising the work access to the records. No idealistic thought stands vaguely behind this policy of cost publicity. The contractor argues that the more men there are in his organization who are familiar with costs and their analysis, the more intelligently and efficiently will his work be handled. He argues further that the more nearly the engineer or the architect knows the contractor's actual costs the more reasonable he will be in consenting to modifications in plans and in granting allowances asked for by the contractor. More surprising than all that has been told, this contractor denies that publishing his costs gives a competitor any advantage. It is efficiency, he says, and not cost data, that makes for low costs. C. S. H.

Ore Cars on Flat-Cars Charge Paving Mixer

STANDARD flat-cars, each carrying 16 ore cars, holding 16 proportioned batches of concrete materials, supply a mixer which is paving street railway track in Denver, Colo. This outfit, operated by the Denver Tramways Co., consists of a mixer, a service car and three supply cars. Each car has tracks on top capable of holding 16 ore cars of 13 cu.ft. capacity each. The ore cars are loaded at the materials yard with proportioned batches.

In operation, the service car remains behind and serves the mixer, and the three supply cars ply between the mixer and the materials yards. On the service car are three narrow-gage tracks converging to one track at the front end. Two tracks are occupied by loaded cars, and the third track is a spare track for empty cars.

In charging, a loaded car is pushed onto the end track, where it is caught by the hooked rail ends and its load is tilted into the mixer hopper. After being emptied, the car is run back onto the spare track.

When the 16 ore cars on the service car have been emptied, a supply car with 16 loaded cars runs up behind, shifts its loaded cars to the service car, and

PAVING MIXER CHARGED BY ORE CARS CARRIED ON FLAT-CARS

Other Articles of Interest to Contractors In This Issue:

Motor Trucks and Plank Roads Help to Get Out Airplane Spruce Page 1164

Supreme Court Fixes Responsibility of Contracts Page 1167

Erection Experiences at the Sciotoville Bridge 1169

Constructing Gravel Road Across Salt Lake Desert Page 1191

Cost-Plus Contracts Great Lesson of War Construction Page 1192

SELF-FEEDING BUCKET LOADER FILLS WHEELBARROWS FROM STONE PILE

replaces them with empty cars from the service car. The runs of the supply cars are scheduled so that one is at the yards being loaded, the second is on its way to the mixer with loaded cars, and the third is returning from the mixer with empty cars. Altogether 64 ore cars are employed. At the service car two men handle an ore car. The "concrete train," as it is commonly called, has worked successfully, and as it keeps the street free from stock piles has met with favor from the business concerns in streets being paved.

Self-Feeding Loader Eliminates Stone Shoveling for Concrete Base

STONE shovelers were replaced by a mechanical outfit for loading wheelbarrows, on recent concrete-pavement base construction in Chicago. Two men trimming the stone stockpile and two men operating the loader kept four wheelers busy on a haul of not to exceed 75 ft. In fact, the loading machine had frequently to wait on the mixer and the concreting crew, although some 1500 sq.yd. of 6-in. base was being laid each day. During war times shovelers for the hard work of loading crushed stone have been difficult to obtain. The mechanical loader was the means sought to relieve this scarcity.

As shown by the view, a bucket elevator takes stone from the pile and discharges it into a forward hopper with a gate under which the wheelbarrows pass and take their loads. The distinctive feature is the bucket-feeding device. This consists of two horizontal steel disks, set close to the ground, which slip under the edge of the stone pile, and revolving toward the buckets, convey the stone to them. The bucket lips just clear the tops of the disks.

The entire outfit is mounted on a truck and is self-propelling, so that, as the stone is taken up, it can be kept in constant contact with the pile. The plant layout on the work referred to was about as indicated by the sketch plan drawn on the view. Four men operated the loader—two trimmers, an operator and a gateman. Four wheelers delivered the stone to the mixer. Sand was loaded and wheeled by four men. Two men handling cement, two men on the mixer and three or four men placing concrete rounded out the working crew. The contractors were the Ryan Co., Chicago.

Following of Definite Rules Improves Construction Photographs

EXACT rules for taking photographs of construction work in progress or completed are necessary for uniformly good results, in the experience of the Austin Co., Cleveland, Ohio. Only 8 x 10-in. films or plates are used. Photographs during construction and after building is completed are taken from the same points. A point is selected which gives a three-fourths front view and shows at least a part of the side of the building. Generally, the best time for an exterior picture is when the shadows are fairly prominent, so that brick work, door openings, etc., are accentuated. Whenever possible there should be one person in the picture to serve as a scale of size. Telegraph poles are to be avoided, but trees covering a small part of the building are not objectionable. A margin is necessary to serve as background. In taking interiors, a view straight down the center of the building is preferred, unless columns interfere; the camera should be slightly to one side of the center and at least 20 ft. from the nearest column. Every print should bear the date of taking and the title.

NEWS OF THE WEEK

New York, December 26, 1918

Harvard Engineering School Reorganized

Undergraduate and Advanced Courses Offered by Independent Teaching Staff

The reorganized Harvard School of Engineering will begin work on Jan. 2, and will continue in session until next September, in order to complete a full school year. The reorganization supersedes the earlier plan for a merger of engineering instruction by Harvard and the Massachusetts Institute of Technology at the new buildings of the latter. This plan was upset by a decision of the Massachusetts Supreme Court that the Gordon McKay millions willed to Harvard could not be used for the merger.

At the outset there will be six departments; (1) mechanical; (2) civil, (3) sanitary and (4) electrical engineering; (5) mining and metallurgy, and (6) industrial chemistry. The school [presumably in accordance with the McKay will—EDITOR] will provide "all grades of instruction from the lowest to the highest," and will be "accessible to pupils" with only high-school education.

The school work will be carried on at Harvard, but one-year arrangements may be made for the use of facilities of other institutions for any part of the school work in advanced technical courses. There may also be interchange of instruction with other institutions, and instruction may be given to students from other schools.

The degree of B.S. will be given on satisfactory completion of a four-year course in any of the departments, and of M.S. for one year's additional study. For a doctor's degree the requirements will be the same as those in the Graduate School of Arts and Sciences.

The school will be administered by a faculty composed at the outset as follows:

Abbott Lawrence Lowell, President.

George Fillmore Swain, Gordon McKay professor of civil engineering.

George Sharp Raymer, assistant professor of mining.

Arthur Edwin Kennelly, professor of electrical engineering.

Henry Lloyd Smyth, professor of mining and metallurgy, and director of the mining and metallurgical laboratories.

Harry Ellsworth Clifford, Gordon McKay professor of electrical engineering.

Lewis Jerome Johnson, professor of civil engineering.

Albert Sauver, professor of metallurgy and metallography.

George Chandler Whipple, Gordon McKay professor of sanitary engineering.

Comfort Avery Adams, Abbott and James Lawrence professor of electrical engineering.

Frank Lowell Kennedy, associate professor of engineering drawing.

Lionel Simeon Marks, professor of mechanical engineering.

George Washington Pierce, professor of physics, and director of the Cruft Memorial Laboratory.

Hector James Hughes, professor of civil engineering and director of the engineering camp.

Edward Vermilye Huntington, associate professor of mathematics.

Gregory Paul Baxter, professor of chemistry.

Lawrence Joseph Henderson, assistant professor of biological chemistry.

Louis Caryl Graton, professor of economic geology.

Arthur Edwin Norton, assistant professor of mechanical engineering.

Harvey Nathaniel Davies, assistant professor of physics.

Grinnell Jones, assistant professor of chemistry.

Emory Leon Chaffee, assistant professor of physics.

Bill for $1,000,000,000 Highway Bond Issue Introduced

A bill providing for the issuance of $1,000,000,000 in bonds, to be used in Federal coöperation with the states in building good roads, has been introduced in Congress by Senator Smoot of Utah. Expenditure of equal amounts by the state and Federal Governments, under state control with Federal approval, is provided for. The bill is similar to that introduced in 1914 by Senator Jonathan Bourne.

New Members Elected to Highway Industries Association

At the annual meeting of the Highway Industries Association, held in Chicago recently, the National Vitrified Pipe Manufacturers' Association and the Lime Association were elected to membership. John L. Rice was elected director to represent the former organization, and R. F. Hall the latter.

Fitting-out Record Made on Lakes

In fitting out the canal-size steamer "Lake Cathcoon" in 13 days and 4 hours from the time of launching, the Buffalo yard of the American Shipbuilding Co. on Dec. 7 achieved a new record for the Great Lakes district, and probably for the entire country. The working time of fitting out was only 12 days and 5 hours.

Bridge Renewal by Rolling Done in Fast Time

Five-Span Greenfield Bridge Replaced In Two Minutes—Old and New Bridges Coupled

Working under adverse weather conditions, bridge erectors replaced the five-span Green River Bridge of the Boston & Maine R.R., at Greenfield, Mass., by a new structure, in less than two minutes' moving time. During the work the atmospheric conditions were such that it was impossible to see the length of the bridge after the hoisting engines started, but the work was completed without delay or difficulty.

Rebuilding the Fitchburg division bridges of the Boston & Maine R.R. is in progress to accommodate increased traffic. The division is double-tracked, but on account of the heavy traffic neither of the tracks can be given up for erection purposes. Detouring was not feasible at the Green River crossing, and the rolling method therefore had to be adopted. The old bridge consisted of three deck truss spans 154 ft. long and two deck girder spans 52 ft. long. The new bridge uses the old masonry. It was erected on falsework upstream of the old structure and swung on timber pier extensions. Similar pier extensions downstream carried the track to receive the old bridge after the moving. The two bridges, resting on roller nests on rails laid on the piers and extensions, were coupled together. Motive power was provided by four hoisting engines set on the new spans, with lines to nine-part ¾-in. wire rope tackles at each end of each span, made fast to the downstream end of the pier extensions. When the tracks were cut the hoisting engines were started, moving the ten spans downstream simultaneously. The pair of bridges was landed against the bumpers at the ends of the roller tracks in 80 sec.; about 30 sec. more was consumed by final adjustment.

The weight of the two bridges was about 2800 tons, and the distance of rolling 26 ft. The Boston Bridge Works, Boston, Mass., carried out the work, under the direction of the engineering department of the railroad.

Rivers and Harbors Congress Will Be Held Next February

Announcement has been made that the fourteenth convention of the National Rivers and Harbors Congress will be held at the New Willard Hotel, Washington, D. C., Feb. 5-7, 1919.

For this convention a radical change in the character of the program has

been decided on. Instead of being taken up with a series of prepared papers and addresses, the time will be given almost entirely to the discussion of transportation questions, including those on which there is the greatest difference of opinion. The opening addresses on both sides of these questions will be given by prominent men who have given special study to the subjects of debate, after which the matter will be thrown open for general discussion. The time of each speaker will be limited.

Engineering Council Resolutions On Land Reclamation

At the regular meeting of Engineering Council, Dec. 19, the following resolutions, submitted by the Public Affairs Committee, was passed:

"Whereas, plans have been prepared, under the direction of the Secretary of the Interior, for the reclamation on a large scale of arid lands, swamp lands, and land from which timber has been removed, with an extent of over 200,000,000 acres, in order to provide employment for returning soldiers and others, and adding to our food-supply resources; and

"Whereas, the need of increasing the area within our borders available for agriculture at this time of world-wide food scarcity is evident to everyone, and

"Whereas, these plans have already been urged upon the attention of Congress by President Wilson in his message of Dec. 2:

"Resolved, that the Engineering Council requests the favorable attention of Congress to these plans; and, to the end that this work shall be conducted on a sound, economic basis, the council especially urges liberal provision for thorough engineering investigations prior to actual construction, so that, in inaugurating this work, selection may be made first of tracts which offer the best prospects of profit in their reclamation, and the plans may be so prepared that the work can be done in the most expeditious and efficient manner."

Car Movement Believed to Establish World Record

What is believed to be the world's record for the greatest number of freight cars passing a given point in 24 hours is indicated in the report of conditions made by the Director General of Railroads to President Wilson. It is stated that in one day 9531 cars passed Columbia, Penn., on the Philadelphia division of the Pennsylvania R.R. The division operates between Harrisburg and Philadelphia, and is directed by Superintendent F. W. Smith, Jr., previously division engineer of the New York and Conemaugh divisions.

The report states that 250,000 freight cars passed Columbia in one month. The average daily movement was 8544 cars, or an average of about six cars per minute.

Negligence Responsible for Forest Fires in Minnesota

Laxity in enforcement of law, carelessness of individuals, unnecessary drainage, and an insufficient ranger force, were responsible for the recent destructive forest fires in Minnesota, according to the report of the state commission appointed to make an investigation. Correction of these shortcomings in the future and immediate state aid for the many sufferers in the present fire are recommended. The commission's report to the Governor says, "We do not find any evidence of any wilful setting of fires for the purpose of intentionally burning any city, town, village or habitation, but negligence under the conditions existing is all too evident." The practice of some settlers in burning over lands to clear them is censured, and it was intimated that railroads, under Government control, had been very negligent.

The fires, which swept over 200,000 acres, taking more than 500 lives and causing property damage of $20,000,000, had no common origin, but were the result of many fires, some of which had been burning for several days. The tremendous wind of Oct. 11 and 12 fanned these into a furnace, and they rapidly spread over the country, which was very dry from lack of rain. There was evidence that several fires, of separate origin, joined and swept on, leaving a wide path of desolation.

In addition to the dryness, the commission found that many needless drainage projects had exposed the peat soil, producing an added danger on account of the inflammability of this material. The report recommended that in the future such projects be studied from the standpoint of their value to the general public, rather than to drainage contractors who wished to do the work. While the commission does not desire to cast any aspersion upon worthy drainage projects, it disapproves of extensive drainage where the soil value of the land drained does not justify the expense. It doubts whether too much importance has not been placed upon the necessity of drainage to protect the public health.

Cleaning up of the débris on burned-over sections was recommended as a precaution. Other recommendations were more stringent laws and greatly extended forest ranger service. It is understood that the forest service department proposes to ask the legislature to appropriate $330,000 per year for this work, instead of the $50,000 allowed for the past year.

Water Power Bill Postponed

An agreement has been reached between the conferees of the House and the Senate who are in charge of the water-power bills now pending in Congress, to take no action in conference until after the first of the year.

Only one meeting of the conferees on the water-power bill has been held since the election in November. This took place a few days ago, but two of the principal members of the conference were absent, and their respective colleagues agreed not to proceed until they can be present. At the meeting of some of the conferees a few days ago, it is reported, Judge Sims, chairman of the House conferees, again strongly urged that action be taken by the conference so that the conference report may be brought before the House and Senate as soon as possible, especially as it is expected there will be extended debate on the conference report in both houses as soon as the report is brought in. But Judge Sims was unable to do more at the meeting than again to call the attention of the conferees to the importance of the proposed measure.

Minnesota Plans for State Trunk Highway System

Tentative plans and a map for a state trunk highway system, for Minnesota, of approximately 6000 miles have been prepared by Charles M. Babcock, commissioner of highways. These plans will be recommended to the coming session of the legislature, for submission to the people at the general election of 1920, as an amendment to the state constitution.

The program provides for the creation of a system to be constructed, reconstructed, improved and forever maintained by the state. A special fund for carrying on the work of improving and building the highways will be created by the amendment, and the legislature will be authorized to levy a higher license tax on motor vehicles than is now levied. This license will cover all other taxes on motor vehicles. The income from this source, together with such Federal-aid money as may be received, and such other receipts as the legislature may authorize, will be applied to the state trunk highway fund. Authorization for bonds to be issued when needed, and to expire in 20-year periods, is planned. A further feature will provide that the state can engage in the work of building highways, a thing the state constitution now prevents.

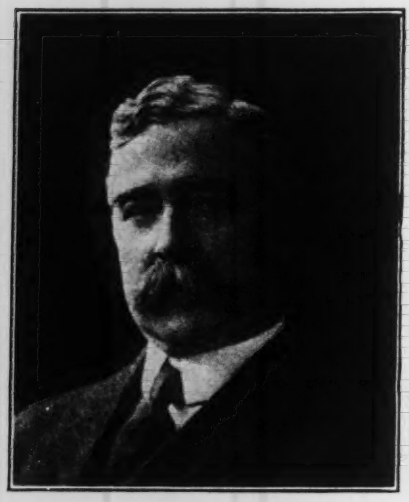
The plans contemplate the connecting of every county seat and every city of 2000, or more. In the selection of the system, the people will be given opportunity to be heard on the routes, and changes will be made where necessary to meet the needs.

Mr. Babcock believes that there will be no objection on the part of the motorist to the increased license fees, as the saving in operation of his vehicle will more than cover the extra expense. There is a unanimous sentiment in the state for a comprehensive system of hard-surfaced highways, according to the commissioner, and he believes that the proposed legislation will meet with the hearty approval of the people of the state.

John Sterling Deans

The death of John Sterling Deans, on Dec. 16, at his home in Phoenixville, Penn., removed one of the most prominent men in the engineering fraternity. The word "fraternity" is used advisedly, for Mr. Deans was a man of magnetic personality who made friends wherever he went.

Engineers are almost invariably wanderers, changing frequently from one situation to another; but Mr. Deans



JOHN STERLING DEANS

spent practically his entire business life with one organization—which is in itself a tribute to his ability and fidelity.

Mr. Deans was born in Chester, Penn., and was trained in engineering at the Polytechnic College in Philadelphia. Thirty-nine years ago he began work for the firm of Clarke, Reeves & Co., builders of iron bridges at Phoenixville, Penn. This firm was reorganized a few years later and became the Phoenix Bridge Co. Young Deans gained steady promotion year by by year, and in 1892 he was made chief engineer, succeeding the late Adolphus Bonzano. He held this position for 23 years, until three years ago, when he became vice-president and consulting engineer of the company.

During Mr. Deans' active professional life of nearly 40 years, the modern art of scientific bridge construction has been developed from small beginnings. The substitution of steel in place of iron as a structural material was one of the most notable changes of the early years, and Mr. Deans did pioneer work in the development of the modern steel structure. Particularly noteworthy was his work in connection with some of the early high viaducts. The Kinzua viaduct in Pennsylvania was built in 1882, the Pecos River viaduct on the Southern Pacific ten years later. The Red Rock cantilever bridge over the Colorado River was erected about the same time.

Other notable structures for which he was responsible were the bridges over the Mississippi River at Rock Island and Davenport, and over the Ohio River at Cincinnati and Louisville. In fact, his company, under Mr. Deans' leadership, played an important part in the development of the modern long-span steel bridge.

Nothing serves more certainly to reveal the character of a man than the test of adversity. The Phoenix Bridge Co. undertook the construction of the first Quebec Bridge over the St. Lawrence. The circumstances are still fresh in the minds of most engineers. The attempt was made to build a bridge within too close limitations of cost, and with inadequate knowledge of the strength of great compression members. The disastrous fall of the south cantilever arm when near completion was such a blow to Mr. Deans' professional and business ambition as it falls to the lot of very few men ever to meet.

The engineers who visited the scene of the disaster immediately after the wreck, and there met Mr. Deans, will always remember his frank and manly bearing, his courage and fortitude. His middle name well expressed his character.

Mr. Deans married Miss Clara Barr of Cincinnati, who survives him, with four children, Capt. John Sterling Deans, Jr., of Buffalo, N. Y., Lieut. Robert Barr Deans of Phoenixville, and two daughters. C. W. B.

Army Organizes Bureau To Dispose of Surplus Property

In order to centralize the disposition of the quantities of stores and supplies for which the Army now has no use, a special bureau of the War Department has been organized.

Benedict Crowell, assistant secretary of war, has appointed C. W. Hare, assistant director of munitions, to have general supervision of this work, and Brig. Gen. C. C. Jamieson has been appointed director of sales in direct charge of an organization to be perfected for the disposal of surplus property.

Form Trunk Highway Association

Meeting in Chicago, Dec. 10, at the time of the Joint Highway Congress held under the auspices of the American Association of State Highway Officials and the Highway Industries Association, were representatives of 12 organized trunk line highways. Preliminary arrangements were made to form these into an association and to hold a meeting at Kansas City as soon as possible after Jan. 15. The newly formed organization tendered its support to the associations holding the congress, for a broad-gage policy for the construction of a system of national highways not to exceed 50,000 miles, to connect the important centers of population and industry, without regard to state lines.

H. O. Cooley, of Minneapolis, representing the Yellowstone Trail, and Wesley L. Connett were elected president and secretary, respectively.

Luten Patent Decision Upheld in Higher Court

On Nov. 11 Judges Sanborn, Carland and Stone, sitting in United States Circuit Court of Appeals, Eighth Circuit, upheld the lower court decision (United States District Court, District of Colorado, Judge Lewis, Nov. 13, 1915) against certain claims in United States Patents No. 825,970, 853,183, 853,202, 853,203, 979,776 and 989,272, issued to Daniel B. Luten, for improvement in concrete bridges. The suit was brought by Mr. Luten against George Washburn and Weld County, Colorado.

Allegheny River Bridge Plan Approved

Plans for the new bridge over the Allegheny River at Sixteenth St., Pittsburgh, drawn by J. G. Chalfant, county engineer, were approved by the county commissioners of Allegheny County last week. The architectural treatment of the bridge is to be referred to the Municipal Art Commission. A ferry has been operated across the Allegheny since the old wooden bridge was destroyed by fire last winter.

Other delayed county improvements in the neighborhood of Pittsburgh are under active consideration by the commissioners. These include a tunnel through the South Hills and a bridge over the Ohio River at McKees Rocks.

Notes from the Field

RECONSTRUCTION PROBLEM

Six of us were in the smoking car on the way back from the reconstruction congress at Atlantic City, when he got on at Hammonton. He wasn't exactly drunk, though the black bottle sticking out of his pocket was evidently not there for decoration, but he was effusively friendly. His cigar wouldn't stay lit, and soon he was begging the loan of a match. The unaccustomed cigar once going again, he swayed in the aisle solemnly, and, looking us over one by one, inquired pleasantly enough, but thickly, "You a bunch of college fellers?" The desired answer was only a step in his train of thought, for there was not a hint of question in his tone when he continued "You fellers all theorists. Me, I'm practical man." Then, fearing that the wide gulf he had put between us might offend, he reassured us. 'S'all right, though. Both of us neces'ry. You theorists, me practical man. Gotta have us both." And, having established his point, he got down to the story he was itching to tell.

"I'm metal lather," he said. "Been metal lather 19 years. Best damn lather in New Jersey. All summer I been workin' down loadin' plant. Got seven'y-two dollars week. Seven'y-two dollars every Friday night all summer." And he paused for emphasis. "Quit the job today, though. Quit'm cold. Wa'je think? Want me—reg'l'r metal lather like me—work for thirty-three dollars week. Can't work for no money

like that." And he became plaintive. "Can't live on less'n seven'y-two dollars week. Can't support family less'n seven'y-two dollars week. Ain' goin' work for nobody less'n seven'y-two dollars week. Let'm go 'thout metal lathers." And he finished with an assertive flourish and retired justified, to his seat, his cigar, his bottle and his grievance.

Next morning there came to the office a well-remembered engineer in the uniform of a major of artillery. Eighteen months ago he was manager of a large contracting company in the Middle West; a year ago he landed in France. Only last October he was in command of one of Pershing's batteries working its way behind the doughboys through the murderous woods of the Argonne. Today he was looking for a job. Not "seeking a business connection" not "offering his services," but just plain "looking for a job."

It is a far cry from the tanned, serious soldier, with technical training plus that executive experience that comes only with high military command, to the dissatisfied workman on the train, but all our plans for reconstruction must reckon equally with the two of them. F. C. W.

Talked Water Meters and Visited Manufacturing Plants

Papers on the use of water meters were read after the luncheon of the New York Section of the American Water-Works Association on Dec. 20, and then those in attendance divided themselves, in so far as they so desired, into three groups for visits to the plants of the National, Neptune and Thompson meter companies.

The meter practice of the Hackensack Water Co., which owns and maintains about 45,000 meters in various New Jersey cities and towns, was outlined by D. W. French. When a meter had passed a given quantity of water it was the practice of his company for many years to take it to the shop, test it and, if need be, overhaul it, regardless of the years the meter had been in service. More recently, under rules of the New Jersey Utility Commission, meters are taken out after a given number of years of service, or after passing a stated quantity of water. The company accounts for 71 to 74% of all water pumped, with no allowances for pump slip, pipe leaks or meter inaccuracies.

W. R. Edwards, of the East Jersey Water Co., speaking of experience in the Paterson-Passaic-Montclair territory, said that over-large meters were to be guarded against on account of under-registration. If the meter is too small the consumer will complain. Up to six families on one service the rule is to use a §-in. meter. As many as 12 families have been supplied satisfactorily through a §-in. meter, Mr. Edwards said. Allen Hazen stated that the Spring Valley Water Co., San Francisco, is changing larger meters to smaller ones.

A. R. Hirst, President of American Association of State Highway Officials

A. R. Hirst, recently elected president of the American Association of State Highway Officials, is state highway engineer of Wisconsin, where he has supervised state highway development from its inception in 1907. He has seen appropriations for the engineering expense of the state highway department rise from $10,000 per year to $185,000, and the amount of work supervised rise to an estimated cost for 1919 of $8,000,000.

A. R. HIRST

Mr. Hirst was born on Long Island, Mar. 31, 1881. He was graduated from the civil engineering course at what is now Maryland State College in June, 1902, with the degree of B. S. in Civil Engineering, and shortly afterward entered the employment of the Pennsylvania R.R.

In April, 1903, he entered the employ of the highway division of the Maryland Geological and Natural History Survey, as transitman and draftsman. When the highway work of Maryland was taken over by the Maryland Roads Commission, he was made engineer of surveys and plans, remaining with the commission in that capacity until May, 1907, when he accepted a position with the Illinois Highway Commission as construction engineer. In August, 1907, he accepted the position of highway engineer of Wisconsin, in the highway division of the Wisconsin Geological and Natural History Survey.

With the passage of the state-aid law in 1911, he was made chief engineer of the Wisconsin Highway Commission, with the title of acting state highway engineer. Within a few months he was made state highway engineer, and has since held the office.

St. Louis Needs $94,000,000 Worth of Public Improvements

Studies made by the City Plan Commission of St. Louis, and published in a pamphlet entitled "St. Louis After the War," show specific public improvements totalling $93,972,000, with no allowances for transit or housing. Estimates made by city department heads, presumably with a view to the more immediate needs of the city, total about $34,000,000. The available borrowing capacity of the city, under a 5% bond limit, is $23,500,000. The City Plan Committee of the Chamber of Commerce, with a membership of 75, recently voted in favor of a $22,000,000 bond issue. Mayor Kiel has appointed a citizens' committee of 25 members to act with city officials in canvassing the whole situation. This committee includes a number of architects and engineers and has as chairman John L. Mauron, president of the American Institute of Architects.

The $34,000,000 estimate made by department heads is as follows:

Improvement of River des Peres	$11,780,000
Repair and construction of sewers	5,655,000
Parks and playgrounds	6,005,500
Municipal convention hall	2,500,000
Municipal farm	700,000
Robert Koch Hospital improvements	200,000
Municipal railroad and docks	2,100,000
Elimination of grade crossings	3,142,200
City's share of street openings	600,000
Garbage reduction plant	550,000
Department of Streets and Sewers	450,000
New fire engine houses and equipment	400,000
Municipal garage	125,000
Additional cells in city jail	100,000
Total	$34,227,700

These items agree in a general way with the estimates of the City Plan Commission for the same objects. In addition, the commission put down $25,000,000 for river-front improvements, $20,000,000 for water-works, and $15,000,000 for public buildings and a group plan. The water-works extension may be financed outside the bond limit.

Seattle Plans for Reconstruction Period

Reconstruction questions of the City of Seattle, Wash., and King County are to be considered by a large commission which has been appointed by Mayor Hansen and which will coöperate with similar commissions throughout the state. In addition to this the city authorities are already planning to commence work on a water-supply extension to cost nearly $4,000,000, a hydro-electric plant to cost $5,500,000, and street and sewer work totaling about $3,000,000.

Steamer Turned on Side Passes Through Canal

Rolled over on its side, a large lake steamer of beam exceeding the width of the locks has been passed through the Welland Canal. The steamer "Charles R. Van Hise," a 9000-ton Great Lakes freighter, was chosen for a tryout of this new method. It was first cut in two lengthwise, as has been done previously with lake steamers too long

for the canal locks but not exceeding in beam the 44-ft. width of the locks.

With a view to securing larger Lake ships for ocean traffic, F. A Eustis, of the United States Shipping Board, suggested that a ship (or half section of a ship) might be sent through the locks when turned on its side, the depth being less than the beam. The "Van Hise" experiment was planned in consequence, and this experiment has just been carried out with success. On Dec. 5 the forward section of the vessel was turned on its side at Buffalo by the agency of pontoon tanks placed along its side at the deck line and filled with water. The half ship was then towed to the Port Colborne entrance to the Welland Canal and passed down to Lake Ontario.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS; 29 West 39th St., New York City; Jan. 15-16, New York.

AMERICAN ROAD BUILDERS' ASSOCIATION; 150 Nassau St., New York City; Feb. 25-28, New York City.

NATIONAL RIVERS AND HARBORS CONGRESS; 824 Colorado Bldg., Washington, D. C.; Feb. 5-7, Washington, D. C.

The American Metric Association will hold its second annual meeting Dec. 27 in Baltimore and Dec. 28 in Washington. The opening session of the meeting will take place at Johns Hopkins University, Baltimore, in conjunction with Section 1 of the American Association for the Advancement of Science. The Washington session will be held at the United States Bureau of Standards. Joseph Hartigan, former commissioner of weights and measures, New York City, will read a paper on "Two Million New American Users of the Metric System."

The Montreal Branch of the Engineering Institute of Canada held a discussion on "Legislation" at a meeting Dec. 19. A welcome was tendered to members who had just returned from overseas, including Lieut Col. A. E. Dubuc, D.S.O., Officer of the Legion of Honor, commanding officer of the 22nd Battalion.

The New Jersey Association of County Engineers will hold its annual meeting Jan. 21. A special meeting is to be held in Newark Jan. 10-11.

The San Francisco Association of Members of the American Society of Civil Engineers held its annual meeting Dec. 17. H. L. Haehl, member of the Committee on Development of the society, reported on the progress made at the Chicago meeting, and the association unanimously passed a resolution requesting that the Board of Direction approve the holding of the next Development Committee meeting during the week of the 1919 annual meeting. The Committee on Licensing Engineers reported the draft or the licensing bill as nearing completion, and it was voted to hold a special meeting to consider the final draft. The election of officers resulted as follows: President, E. J. Schneider; vice-president, M. M. O'Shaughnessy; secretary-treasurer, Nathan A. Bowers. The address of the evening was delivered by Maj. George F. Sever on the subject of "Economic and Financial Aspects of the Water-Power Situation on the Pacific Coast."

The Idaho Irrigation Congress will be held at Twin Falls, Jan. 13-16 as a joint conference between the agricultural, livestock, engineering and irrigation societies of Idaho. Among the subjects to be discussed are the electrical reduction of ores, the highways of Idaho, and the irrigation possibilities in Southern Idaho.

The Colorado Association of Members of the American Society of Civil Engineers held a meeting and dinner Dec. 21 at which Thomas L. Wilkinson, member of the Committee on Development of the society, reported on the work of the committee at the first meeting in Chicago, as outlined in *Engineering News-Record* of Dec. 5, p. 1045. The association's Committee on Legislation, appointed in accordance with resolutions adopted at the previous meeting, reported on the question of licensing civil engineers in Colorado. Arthur O. Ridgway addressed the meeting on "Unit Values for Transportation Service."

The Calgary Branch of the Engineering Institute of Canada held its annual meeting in Calgary Dec. 9. M. C. Costello and R. C. Marshall, candidates for the mayoralty of the city, spoke on their respective programs, deeling particularly with matters of interest to the profession and including a proposed sewage disposal plant for the city, town planning and housing.

The Nebraska Association of Members of the American Society of Civil Engineers will hold its annual meeting at Lincoln Jan. 4, at which meeting the work of the Committee on Development of the society will be discussed. It is also planned to discuss matters which will come before the next meeting of the Nebraska legislature.

The Chicago Association of Commerce Engineers' Subdivision on Dec. 18 elected the following officers for 1919: Chairman, W. W. DeBerard; vice-chairman, J. N. Hatch; additional members of the executive committee, C. O. Billow, H. W. Clausen and C. E. Keller.

The Engineers' Club of Minneapolis is holding a series of meetings for the purpose of discussing post-war problems. The meeting Nov. 29 was devoted to a discussion of "Education of the Coming Engineer," at which extracts from Dr. C. R. Mann's recent report on engineering education were read by C. L. Pillsbury. The discussion was led by John R. Allen, dean of the College of Engineering, University of Minnesota. On Dec. 16 L. S. Gillette, of Minneapolis, director of the United States Chamber of Commerce, addressed the club on "Reconstruction Problems." He included an account of the recent reconstruction congress at Atlantic City. At the next meeting in January the topic will be "Road Program in the State of Minnesota."

The Detroit Engineering Society was addressed Dec. 20 by William B. Landreth, deputy state engineer of New York, who read a paper on "The New York State Barge Canal," illustrated with lantern slides and moving pictures.

The Spokane Association of Members of the American Society of Civil Engineers elected the following officers Dec. 13: President, H. J. Doolittle; vice-president, C. A. Burnette; secretary-treasurer, Charles Davis.

The Pittsburgh Chapter of the American Association of Engineers was addressed on Dec. 20 by Prof. H. R. Thayer, of the Carnegie Institute of Technology, who spoke on "The Problem of Reconstruction."

The Toronto Branch of the Engineering Institute of Canada elected the following officers at a recent meeting: Chairman, A. H. Harkness; secretary-treasurer, W. S. Harvey.

The Engineers' Club of Trenton, N. J., elected the following officers at the annual meeting held Dec. 12: President, Charles R. Fairchild; first vice-president, Alfred P. S. Bellis; secretary, Joseph E. English.

The Engineers' Club of Philadelphia will be addressed by Fullerton L. Waldo of the Philadelphia *Public Ledger*, on "America at the Front," at the weekly luncheon to be held Dec. 31.

PERSONAL NOTES

S. M. FELTON, director general of military railways, has resigned, effective Dec. 31, when, it is expected, he will resume his duties as president of the Chicago Great Western Railroad.

MAJ. F. L. C. BOND has been appointed chief engineer, Grand Trunk Ry. System, with headquarters at Montreal, succeeding H. R. Safford, recently appointed engineering assistant to the regional director of the Central Western region, United States Railroad Administration. He recently returned from overseas after two years' service with the 10th Battalion, Canadian Railway troops. Major Bond was born in Montreal in 1877, and received

his education at the Collegiate Institute and McGill University. After his graduation from McGill in 1898 he entered the service of the Grand Trunk as assistant resident engineer, eastern division, and in 1901 was appointed engineer in charge of double-track construction. In 1913 he became division engineer, Grand Trunk, Eastern Lines.

CAPT. JOHN P. WENTWORTH, Sanitary Corps, U. S. A., formerly of Metcalf & Eddy, consulting engineers, Boston, has been transferred from Camp Wheeler, Macon, Ga., to Camp Bragg, Fayetteville, N. C., as camp sanitary engineer.

LT. COL. H. S. BAKER, 111th Engineers, in service in France, formerly first assistant city engineer, Chicago, is now Colonel Baker. At the beginning of the war Colonel Baker was constructing quartermaster at Camp Bowie, Texas, with the rank of captain.

JOSEPH B. EASTMAN of Massachusetts has been nominated by the President to succeed George W. Anderson as a member of the Interstate Commerce Commission. Notification of the nomination was received from the President by wireless Dec. 19.

FRANKLIN D. HOWELL resigned recently as chief engineer of the Board of Public Utilities, Los Angeles, to become general manager of the California Highway Transportation Co., recently organized to carry on motor transportation.

CAPT. D. D. GUILFOIL, 108th Engineers, now in France, and formerly contracting engineer for Sauerman Bros., Chicago, has been promoted to the rank of major. He was one of the original members of Co. A., Corps of Engineers, Illinois National Guard, which formed the nucleus of the 108th Regiment of Engineers.

CARL R. GRAY, formerly president of the Western Maryland Ry., has resigned as director of the division of operation, United States Railroad Administration.

IRA E. TAYLOR has been appointed assistant engineer of the drainage and irrigation department, extension division, Kansas State Agricultural College, Manhattan, Kan. Mr. Taylor has just returned from the Engineer Officers' Training School at Camp A. A. Humphreys, Virginia. He will specialize in farm drainage work.

F. P. WILLIAMS, Rochester, N. Y., division engineer, New York State Barge Canal, has been appointed special deputy state engineer. After his graduation from Cornell University he entered the State Engineer's Department as assistant engineer in 1904, engaging in highway work. He became resident engineer in the canal department in 1906, and in 1914 was made division engineer.

ROY D. CHAPIN, for the past year chairman of the National Highways Transport Committee, resigned recently to return to his duties as president of the Hudson Motor Car Company.

LIEUT. THOMAS B. BERGAN, who received leave of absence as city engineer of Auburn, N. Y., to enter the Sanitary Corps, U. S. A., has returned to his work as city engineer.

FREDERICK HOLBROOK, president of the American International Shipbuilding Corporation, has tendered his resignation. He will be succeeded by M. C. Brush, chairman of the board of directors and former president of the Boston Elevated Railway Company.

JOHN CRAVEN, chief of the field section of the Council of National Defense, is now chairman of the National Highways Transport Committee, in succession to Roy D. Chapin, who resigned, as mentioned elsewhere in this column.

MAJ. EDWARD BOSTOW, Sanitary Corps, U. S. A., in charge of water analysis laboratories, and formerly director of the Illinois water survey, has been promoted to the rank of lieutenant colonel.

MARTIN C. POLK, city engineer of Chico, Cal., and for several years surveyor of Butte County, has been placed in charge of all highway construction and maintenance in the county. The office was recently created by a newly adopted county charter.

OBITUARY

CHARLES E. PHELPS, former chief engineer, Public Service Commission of Maryland, died in Baltimore, Dec. 22, at the age of 47

CAPT. CLYDE L. WESTCOTT, formerly superintendent of construction, Los Angeles Union Terminal buildings, died recently in Los Angeles. Captain Westcott was commissioned Oct. 21 and had been stationed at Fort Douglas, Utah.

A. R. W. SPERRY, whose death Dec. 6 was noted in these columns last week, was graduated from the University of California in 1910, after which he became inspector and instrumentman for the Associated Pipe Line Co. He was also identified with various irrigation construction enterprises in the Central Valley, being for three years associated with the Natomas Co., engaged in developing extensive irrigation tracts and building irrigation structures. At the time of his death Mr. Sperry was chief engineer of the Anderson-Cottonwood Irrigation District.

BERNARD NADAL BAKER, Baltimore, retired capitalist and steamship operator, died at Santa Barbara, Cal., Dec. 20. He was formerly a member of the United States Shipping Board, and in business was best known as the organizer of the Atlantic Transport Co. He was born in 1854 and attended Sheffield Scientific School, Yale University. He started the Atlantic Transport Co. with one steamship in 1886, remaining in control of the company until it was absorbed by the International Mercantile Marine Co. in 1902, when 17 steamships were turned over to the new organization. He took an active part in the movement for strengthening the merchant marine of this country and supplied much data, for the Shipping Bureau, debated in the United States Senate in 1915. He was one of the four recognized transportation experts selected by Secretary McAdoo for the National Subcommittee on Transportation Problems.

HERMANN LAUB, consulting engineer, Pittsburgh, died in that city Dec. 10 at the age of 63. In 1881 and 1882 he was assistant engineer on the location and construction of the Guanajuato branch of the Mexican Central Ry. between Silao and Marfil, later becoming principal assistant engineer under A. M. Wellington on the location of the Pacific branch, between Guadalajara, Ameca, Tepic and San Blas. The maps in Wellington's "Railway Location" were made by Mr. Laub. In 1884 he returned to the United States and became connected with the Iron City Bridge Works, Pittsburgh, later becoming associated with Gustav Lindenthal, consulting structural engineer. Subsequently he engaged in private practice, and was in charge of the design and erection of various structures in the Pittsburgh district.

J. HUMPHRIES, Winnipeg, Man., engineer, good roads department of public works of Manitoba, died Dec. 15 at the age of 33. He enlisted in the Canadian Engineers in 1915 and was in active service on the Somme. He had received his discharged on account of ill health.

T. M. CHAPMAN, superintendent of fire prevention, Central of Georgia R.R., died Dec. 4 at the age of 45. Almost all of his engineering experience was in railroad maintenance and construction. He was a member of the National Board of Directors of the American Association of Engineers.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Argentine Railways Offer Market for Equipment

Inspector Estimates $100,000,000 Will Be Spent on Rolling Stock and Appliances

The railways of Argentina will spend over $100,000,000 on rolling stock and equipment in the next two years, according to a statement by Fred A. Lagrange, technical inspector of the Argentine Government railways. If the manufacturers of American railway supplies will conform to Argentine railway standards, he says, there will be a market for their products, and even the introduction of American standard equipment, though difficult at any time, will be easier in the immediate future on account of the temporary withdrawal of European competition. European manufacturers, he states, will have to give close attention to necessities at home for some years to come.

The complete system of railroads in the republic has about 11,000 miles of track, of which about 6500 miles are of 6-ft. 5-in. gage, about 900 miles of 4-ft. 9½-in. gage, and about 3600 of the 3-ft. 4-in. gage. The Argentine government owns about 1900 miles, or 18% of the total, which is under the direction of the "Administraccion de los Ferrocarriles del Estado," a board composed of a chief engineer, a chief of exploitation and an auditor general. It is presided over by an administrator who is appointed by the President of the republic. The other members of the board are appointed by the administrator. All of the railroads are under the control of the "Direccion General de Ferrocarriles" (Argentine Administration of Railroads) which is headed by an Argentine engineer reporting directly to the Minister of Public Works.

During the last four and a half years the railways have been unable to obtain materials, so that their maintenance and reserve stocks are very low and an expenditure of about $100,000,000 for the next two years is probable. In addition to this, extensions are to be built, for several of which there is urgent need. It is expected that they will amount to about 1000 miles and entail an expenditure of $75,000,000. This is exclusive of the electric lines, which will also receive considerable attention, according to Mr. Lagrange.

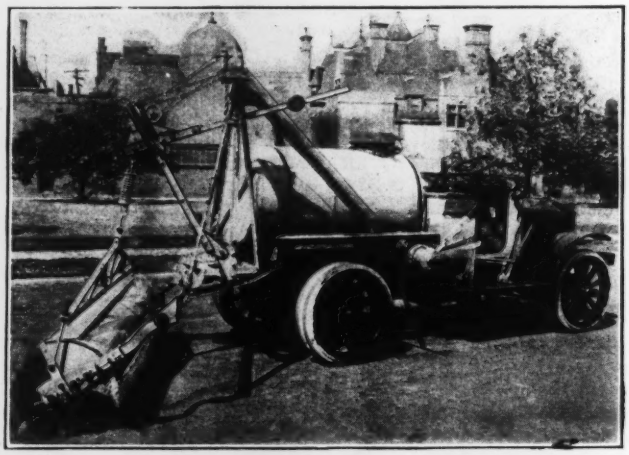
In conclusion, he points out that although the opportunities are favorable for the introduction of American equipment, the market cannot be gained without a struggle, and that success will depend on close study and sound business principles.

Auto Industry Will Absorb Surplus Government Machines

The surplus stocks of automobiles and trucks in the War Department will be taken up by the automobile industry. An agreement to this effect was recently made between representatives of the auto manufacturers and officials of the War Department, the action having been taken to prevent a disorganization of the business by a possible flooding of the market with Government machines. The War Department announces, however, that there is no immediate probability of this, because the indications at present are that the Government machines will be needed for some time, and care will be taken to cause the trade as little disturbance as possible.

Car-Building Plant to Cost $2,000,000 Projected

The Youngstown Steel Car Co. has announced that plans have been completed for the erection of a $2,000,000 car-building plant. It will be located at Niles, Ohio, will employ approximately 2000 men and will have a capacity of 75 cars per day.



SWEEPER AND SPRINKLER ADAPTED TO MOTOR TRUCK CHASSIS

Increased Facilities for Promoting Foreign Trade Asked

Expansion of Government facilities for promoting foreign trade is urged in the annual report of the Chief of the Bureau of Foreign and Domestic Commerce. The measure is advocated on the strength of the important position the United States will hold in international trade.

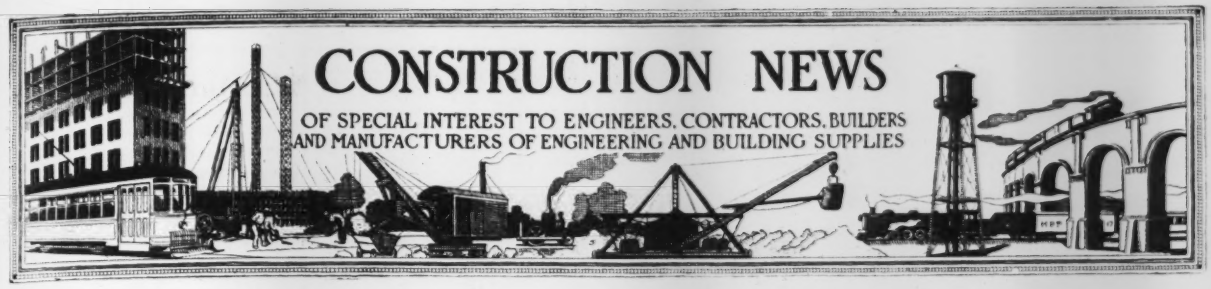
Extension of the field of the commercial attaché and trade commissioner for this work is particularly urged in the report, because the value of the promotive work done by these field representatives in the past is generally conceded. Trade commissioners, who can travel from place to place in specified districts, are also needed to send in news of the national resources and the trade opportunities in their localities. New attachés are asked for Rome, Madrid, Ottawa, Mexico City, Santiago (Chile) and Athens, and trade commissioners in Colombia and Venezuela, the Dutch East Indies, Egypt, South Africa and New Zealand.

Bridge Builders Report 27 Per Cent of Capacity Taken

The records of the Bridge Builders' and Structural Society, as collected by its secretary, show that during November, 1918, 27% of the entire capacity of the bridge and structural shops of the country was contracted for.

Sweeper Sprinkler Attachment for Motor Truck

Any standard motor-truck chassis may be converted into an efficient street sweeper by the rotary broom and sprinkler attachment, as in the accompanying view. The connection of the broom is the important detail. An A-frame and boom provide for raising and lowering the broom by means of a hand winch. Once set to proper height, the broom is held from going down further by the chain shackle between the top of the A-frame and the boom tip; as the broom wears, the chain is lengthened. Vertical adjustment of the broom to irregularities of the pavement is provided for by its suspension from a counterbalanced lever hinged to the boom. The broom sweeps 6 ft. wide. The water is supplied by a force pump from a 350-gal. tank to the transverse sprinkler pipe set ahead of the rear wheels and is applied to the pavement by atomizers.


CONSTRUCTION NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

PROPOSALS

For Proposals Advertised See Pages 52-54 inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Dec. 31	Cohoes, N. Y.	Dec. 19
Jan. 2	Galesburg, Ill.	Dec. 12
	Adv. Dec. 5, 12, 19 and 26.	
Jan. 7	Inverness, Miss.	Dec. 19
Jan. 10	Houston, Tex.	Dec. 12
Jan. 31	Poteau, Okla.	Dec. 26
	Adv. Dec. 19 and 26.	

SEWERS

Jan. 2	Sanger, Cal.	Dec. 26
Jan. 9	Globe, Ariz.	Dec. 30
	Adv. Dec. 19 and 26.	

BRIDGES

Jan. 2	New Brunswick, N. J.	Dec. 12
	Adv. Dec. 12, 19 and 26.	
Jan. 3	Great Bend, Kan.	Dec. 19
Jan. 6	Tulsa, Okla.	Dec. 12
	Adv. Dec. 12, 19 and 26.	
Jan. 10	Little Rock, Ark.	Dec. 26

STREETS AND ROADS

Dec. 31	Jersey City, N. J.	Dec. 26
Dec. 31	Virginia	Dec. 26
Jan. 3	Great Bend, Kan.	Dec. 19
Jan. 4	Johnstown, Pa.	Dec. 19
Jan. 6	Mangum, Okla.	Dec. 19
Jan. 6	Tulsa, Okla.	Dec. 12
	Adv. Dec. 12, 19 and 26.	
Jan. 6	Seattle, Wash.	Dec. 26
Jan. 6	Holbrook, Ariz.	Dec. 26
Jan. 8	Riverside, Cal.	Dec. 26
Jan. 14	Bay City, Tex.	Dec. 26
Jan. 15	Blytheville, Ark.	Dec 5

EXCAVATION AND DREDGING

Jan. 3	Brownsville, Tenn.	Dec. 12
Jan. 3	Terra Ceia, N. C.	Dec. 12
	Adv. Dec. 12.	
Jan. 7	Albany, N. Y.	Dec. 12
	Adv. Dec. 12, 19 and 26.	
Jan. 9	Bridge Junction, Ark.	Dec. 12
Jan. 11	Greenfield, Ind.	Dec. 26
Jan. 14	Albany, N. Y.	Dec. 26
	Adv. Dec. 1 9and 26.	
Jan. 15	New Ulm, Minn.	Dec. 26
Jan. 15	York, S. C.	Dec. 26
Feb. 3	Madisonville, Ky.	Dec. 19
	Adv. Dec. 5, 12 and 19.	

BUILDINGS

Jan. 6	Lyons, Ga.	Dec. 26
Jan. 9	Detroit, Mich.	Dec. 26
Jan. 14	Cherokee, Ia.	Dec. 19
Feb. 3	St. Paul, Minn.	Oct. 31
Mar. 15	Culver, Ind.	Dec. 26

FEDERAL GOVERNMENT WORK

Bids Close		See Eng. News-Record
Dec. 30	Shop and Industrial Buildings—Spec. 3675—Galveston, Tex.	Dec. 5
Dec. 30	Radial Block Chimneys — Spec. 3712 — Washington, D. C.	Dec. 19
Dec. 30	Radio Building, Garage, Barracks, etc.—Spec. 3683 —Monroe, N. C.	Dec. 12
Dec. 30	Additional Buildings—Spec. 3686—Cape May, N. J.	Dec. 12
Dec. 30	Cranes—Spec 3681—Washington, D. C.	Dec. 12
Dec. 30	Boilers—Detroit, Mich.	Dec. 12
	Adv. Dec. 12, 19 and 26.	
Dec. 30	Quarters for Marine Officers Spec. 3717 — Iona Island, N. Y.	Dec. 19
Dec. 30	Altering Court House, — Montgomery, Ala.	Dec. 19
Dec. 30	Nurses Quarters—Stapleton, N. Y.	Dec. 19
	Adv. Dec. 12 and 19.	
Dec. 30	Extensions "A" to Power Plant — Spec. 3632 — New York, N. Y.	Dec. 19
Dec. 30	Photographic Laboratory— Spec. 3692 — Key West, Fla.	Dec. 19
Dec. 30	Oil Storage Building, etc.— Spec. 3714 — Hampton Roads, Va.	Dec. 19
Dec. 30	Deepening Waterways — New Orleans, La.	Dec. 19
	Adv. Dec. 12, 19 and 26.	
Jan. 2	Lavatory Annexes—Washington, D. C.	Dec. 12
Jan. 3	Post Office—Park City, Utah	Dec. 5
Jan. 3	Post Office—Newburyport, Mass.	Dec. 5
Jan. 3	Post Office—Mt. Carmel, Ill.	Dec. 5
Jan. 6	Post Office — Bakersfield, Cal.	Dec. 5
Jan. 6	Post Office — Lancaster, S. C.	Dec. 5
Jan. 6	Post Office—Caribou, Me.	Dec. 5
Jan. 6	Hangars, Pavement and Beach — Spec. 3432 — Galveston, Tex.	Dec. 19
Jan. 6	Railroad — Spec. 3718 — Bellevue, D. C.	Dec. 19
Jan. 6	Railroad Track—Spec. 3265 —Hingham, Mass.	Dec. 19
Jan. 7	Post Office — Woodbury, N. J.	Dec. 5
Jan. 7	Post Office—Fremont, O.	Dec. 5
Jan. 7	Altering Post Office—Canton, O.	Dec. 26
Jan. 7	Post Office and Court House —Alexandria, La.	Dec. 5
Jan. 8	Post Office—Prescott, Ark.	Dec. 5
Jan. 8	Post Office—Cody, Wyo.	Dec. 5
Jan. 8	Post Office — Waterloo, N. Y.	Dec. 5
Jan. 9	Post Office—Orange, Tex.	Dec. 5
Jan. 9	Post Office — State College, Pa.	Dec. 5
Jan. 9	Post Office and Court House —Durango, Colo.	Dec. 5
Jan. 10	Post Office — Front Royal, Va.	Dec. 5
Jan. 10	Post Office—Vineland, N. J.	Dec. 5
Jan. 10	Altering Lobby—New York, N. Y.—Adv. Dec. 19 and 26.	Dec. 26
Jan. 13	Additional Buildings—Spec. 3611—San Diego, Cal.	Dec. 19
Jan. 13	Post Office—West Point, Ga.	Dec. 5
Jan. 13	Post Office and Custom House—Ft. Fairfield, Me.	Dec. 5
Jan. 13	Post Office and Court House —Globe, Ariz.	Dec. 5
Jan. 14	Post Office — Southbridge, Mass.	Dec. 5
Jan. 14	Post Office—Cherokee, Ia.	Dec. 5
Jan. 14	Post Office—McKees Rocks, Pa.	Dec. 5
Jan. 15	Altering Post Office—Portsmouth, Va.	Dec. 26
Jan. 15	Post Office — Long Island City, N. Y.	Dec. 5
Jan. 15	Post Office—Kenton, O.	Dec. 5
Jan. 15	Post Office — Bellefourche, S. D.	Dec. 5
Jan. 15	Post Office — Winchester, Mass.	Dec. 5
Jan. 16	Post Office—Eldorado, Kan.	Dec. 5
Jan. 16	Post Office—Shawnee, Okla.	Dec. 5
Jan. 17	Post Office—Franklin, Pa.	Dec. 5
Jan. 17	Post Office—Cohoes, N. Y.	Dec. 5
Jan. 17	Post Office—Buffalo, Wyo.	Dec. 5
Jan. 20	Post Office — Harrisonville, Mo.	Dec. 5
Jan. 20	Post Office—Owego, N. Y.	Dec. 5
Jan. 20	Post Office—Sunbury, Pa.	Dec. 5
Jan. 20	Post Office—Decatur, Ala.	Dec. 5
Jan. 20	Post Office — Shelbyville, Ind.	Dec. 26

MISCELLANEOUS

Dec. 27	Electrical Equipment—Jersey City, N. J.	Dec. 12
Dec. 27	Blanket—New York, N. Y.	Dec. 19

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

Water-Works

PROPOSED WORK

Pa., Freeport—Boro. plans to build addition to water-works plant.

Pa., Pittsburgh—City plans to issue $63,000 bonds for relaying water pipes and making connections on West Carson St. between Point Bridge and Main St. N. S. Sprague, city engr.

Wis., Oshkosh—City plans to issue $50,000 bonds to improve water-works. D. Wetzel, city clk.

Minn., Pipestone—City receives bids in January or February building waterworks system. Work includes concrete reservoir, brick pump house and tower and extension to water main. About $77,000. L. P. Wolff, 1000 Guardian Life Bldg., St. Paul, engr.

Kan., Hiawatha—Comrs. Brown Co. and City plan election to vote $25,000 bonds to build addition to water plant.

Kan., Scott—City receives bids in January building water-works system. About $82,000. Black & Veatch, 507 Interstate Bldg., Kansas City, Mo., engrs. Noted Oct. 17.

Neb., Bayard—City plans election to vote on $28,000 bonds to build new water-works system.

Mo., St. Louis — City had preliminary plans prepared for addition to waterworks system on Missouri River near Creve Coeur Lake. E. E. Wall, 312 City Hall, water comr. Bond issue of $20,000,000 has been recommended to City by H. Bartholomew, city engr.

Tex., Hillsboro—City voted $40,000 bonds to extent water-works system and drill 2800 ft. artesan well. W. T. Renfro, supt.

Okla., Bristow—City election Jan. 2, to vote on $15,000 bonds to extend water works.

Water-works (Continued)

Cal., Modesto—City plans to sell $30,000 bonds to complete and extend water-works system and install pumping equipment. Noted Oct. 24 under "Streets and Roads."

Ont., Stratford—City plans to expend about $12,000 to increase capacity of pumping station.

BIDS DESIRED

Tex., Houston—Until Jan. 10, by E. E. Sands, city engr., improving waterworks system. Plans include 7 deep wells, deep well pumps, motor and electric generators. About $160,000. Noted Dec. 12.

Okla., Poteau—Until Jan. 31, by A. W. Lindsey, city clk., building water-works and filter plant. Work includes brick pumping station and filter house, sedimentation basin, reservoir, two boilers, pumping engines, three steam engine or turbine driven centrifugal pumping units, other pumps, etc.; advertised in this issue.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

N. Y., Brooklyn—E. Riegelmann, pres. Brooklyn Boro., received bids Dec. 20, repairing sewer in 49th St. from 1st to 2nd Aves., from P. J. Donlan Contg. Co., 84 Bway., $11,397; E. Ghelardi, 2617 Delamire Pl., $12,430; J. Jennings, 3127 Ferris St., Woodhaven, L. I., $13,267.

Ill., Great Lakes—City received lowest bid building addition to water system, from W. D. Lovell, 1415 South East 8th St., Minneapolis, Minn., $79,949.

★**Wis., Milwaukee**—Bd. Pub. Wks. let contract building 2 steel lined concrete shafts, 181 ft. long, 10 ft. inside diameter, 1 west side West Water St. and north Menominee River, 1 west side Reed St., south Menominee River; rein.-con. lined tunnel 268 ft., 7 x 9 ft. inside diameter underneath bed of Menominee River between above shafts and west of present bascule bridge; placing 440 ft. 24 in. c.i. water pipe line in said shafts and tunnel; 765 ft. 20-24 in c.i. pipe laid in trenches from shafts to connecting mains in Reed and 3rd Sts. extended, to H. Hohensee, 965 27th St. About $80,427. Noted Dec. 12.

Sewers

PROPOSED WORK

N. Y., Rochester—L. E. Sebring, city engr., soon receives bids for 9000 ft. 24 in. tile sewer to be laid in bed of old Erie canal from Washington Ave. to Church St.

O., Toledo—See "Streets and Roads."

Minn., Columbia Heights—City receives bids about June building 2 sq.mi. sewerage system. J. W. Shaffer, New York Life Bldg., Minneapolis, engr. Noted Dec. 12.

Mo., St. Louis—City plans to issue $25,000 bonds to improve sewers and drainage system in parks. E. R. Kinsey, pres. bd. pub. serv.

(., Bristow—City election Jan 2, to vote on $20,000 bonds to extend sewerage system.

Cal., Fresno—City plans to issue $200,000 bonds to build main trunk line sewer in North Fresno. About 1100 acres will be affected by this plan. C. Murray, city engr.

Cal., Modesto—City plans to sell $10,000 bonds to build and complete additional sanitary sewers. Noted Oct. 24 under "Streets and Roads."

Cal., Sacramento—I. A. Bedford, div. engr., submitted report to State Highway Comn., estimating cost of constructing state highway lateral in north fork of Feather River Canyon as follows: Excavation, $750,032; concrete and masonry work, $114,750; corrugated iron pipe, $47,656; reinforcing steel, $16,221; cement, $16,530; monuments, $2800; engineering, etc., $94,799.

Ont., Orillia—See "Streets & Roads."

BIDS DESIRED

Ariz., Globe—Until Jan. 9, by Mayor and City Council, building sanitary sewers and sewage disposal plant. Benham Eng. Co., Colcord Bldg., Oklahoma, engrs.; advertised in this issue. Noted Dec. 19.

Cal., Sanger—Until Jan. 2, by A. M. Burns, city clk., building addition to sewerage system, including sewage disposal plant, distributing system and extensions to main outfall sewer to sewage disposal works site. About $10,000. R. C. Phillips, city engr. Noted Mar. 28.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★**N. Y., Long Island City**—E. Connolly, pres. Queens Boro., let contract building sewer in Wool St. from Grand to Weimer Sts., Koerner St. from Weimer St. to point east of Wool St., Manheim St. from Weimer St. to point east of Wool St. and Weimer St. from point east to point west of Wool St., to Carmine Contg. Co., 800 Kent Ave., Brooklyn, $14,019. Noted Dec. 12.

★**Wis., Sheboygan**—City let contract building sewers in South 14th, 15th, 16th, 17th and Henry Sts., Oakland and Ashland Aves., to E. Oldag, Jr., Co., Sheboygan. About $24,987.

Bridges

PROPOSED WORK

Pa., Glassport—Comrs. Allegheny Co., (Pittsburgh) having preliminary plans prepared by J. G. Chalfant, engr., City-County Bldg., Pittsburgh, building bridge over Monongahela River from here to Wilson. About $1,000,000.

Pa., McKees Rocks—Comrs. Allegheny Co., (Pittsburgh) having preliminary plans prepared by J. G. Chalfant, engr., City-County Bldg., Pittsburgh, building steel bridge over Ohio River from here to lower North Side. About $2,600,000.

Pa., Pittsburgh—Comrs. Allegheny Co. having preliminary plans prepared by J. G. Chalfant, engr., City-County Bldg., building steel bridge over Allegheny River from 16th St. to North Side; also steel bridge over Allegheny River from 40th St. to Millvale. About $1,000,000 and $1,250,000, respectively. City will bear part of cost.

Md., Baltimore—J. E. Greiner, consult. engr., 1319 Fidelity Bldg., submitted tentative plans for construction of 9 mi. bridge over Chesapeake Bay from Bay Shore, Baltimore Co., to point between Love Point and Tolchester, Kent Co. Plans include rein.-con. double decked bridge, double railway tracks above and auto and wagon way below, with 150 ft. draw at channel. Two widths were suggested, one 40 ft., to cost $18,000,000 and one 30 ft. to cost $12,000,000. F. H. Zouck, chn. State Rds. Comn. Noted Dec. 12.

O., Toledo—City plans to expend $191,750 for bridge work in connection with extension of Summit St. across Swan Creek. H. A. McClure, city engr.

Ark., Glenwood—Comrs. Pike Co. (Murfreesboro), having plans and estimates made by Burnham Eng. Co., engrs., Glenwood, building concrete bridge over Caddo River here. About $45,000. A. Roundtree, co. judge.

BIDS DESIRED

Ark., Little Rock—Until Jan. 10, by L. Miles, judge Pulaski Co., building rein.-con. bridge over Arkansas River on B'way St., involving 24,400 cu.yd. concrete, 1,680,000 lb. steel, 12,000 sq.yd. wood block pavement and 23,400 cu.yd. earth embankment. About $600,000. Hedrick & Hedrick, 506 Interstate Bldg., Kansas City, Mo., consult. engrs. Noted Oct. 17.

Nev., Wayne—Until Jan. 3, by C. W. Reynolds, co. clk., building 20 ft. concrete arch, 18 ft. roadway between Sects. 15 and 16, Twp. 26, about ¾ mi. south of north line of said Sects.; 20 ft. concrete slab, 18 ft. roadway between Sects. 28 and 29-27-2 about 70 rods south of north corners of Sect.; 40 ft. steel girder, 18 ft. roadway between Sects. 27 and 28, Twp. 26, 1 rod north of south corner of Sects.; 40 ft. span, 16 ft. roadway between Sect. 1-27-1 and Sect. 6-27-2, about 10 rods north of south corners of said Sects.; 24 ft. steel I-beam, 16 ft. roadway between N. E. 1-4 About ¾ mi. south of north corner of said Sects.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★**N. J., Jersey City**—Pennsylvania R. R., Broad St. Sta., Phila., Pa., let contract to Vassilarios Cox, Nassau St., New York City, for painting, scraping and repairing following 7-track bridges on Erie, Coles, Monmouth and Brunswick St. and Jersey Ave. About $15,850.

Structural Steel

PROPOSED WORK

Pa., McKees Rocks—See "Bridges."

Cal., Sacramento—See "Sewers."

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★**Md., Sparrows Point**—See "Industrial Works."

★**Minn., Olivia**—See "Excavating and Dredging."

★**Mo., Kansas City**—See "Buildings."

Reinforced Concrete

PROPOSED WORK

Pa., Phila.—See "Industrial Works."

Md., Baltimore—See "Bridges."

Mich., Flint—See "Buildings."

Wis., Fond du Lac—See "Industrial Works."

Minn., Pipestone—See "Water-Works."

Tex., Beaumont—See "Excavation and Dredging."

Cal., Sacramento—See "Sewers."

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★**Ill., Chicago**—See "Buildings."

★**Minn., Olivia**—See "Excavation and Dredging."

Streets and Roads

PROPOSED WORK

N. J., Jersey City—City plans to improve Spruce St. between Collard St. and Tonnele Ave. and Liberty Ave. between Thorne St. and Manhattan Ave. D. O'Regan, city clk.

N. J., Trenton—City appropriated about $15,000 for laying out and opening Commercial Ave. J. R. Fell, city engr.

Pa., Uniontown—Fayette Co. will sell $94,000 bonds to build and improve roads. H. Kissinger, co. controller.

Va., Petersburg—City plans to build concrete roadway on East Bank from gashouse to city limits. About $15,000 appropriated for project. R. T. Budd, city engr.

S. C., Charleston—B. M. Thomson, engr. sanitary & drainage comn., soon lets contract building 3.5 mi. road, 30 ft. wide, 9 in. center and 7 in. side. Work involves 35,000-58,000 sq.yd. concrete.

Fla., Dade City—City rejected bids received Nov. 5 for 12,000 sq.yd. asphalt pavement and 7000 lin.ft. concrete curb. J. L. Turner, clk. Noted Oct. 31.

O., Toledo—City plans to expend $110,000 for grading; $147,350 for sidewalks, paving and sewers in connection with extension of Summit St. across Swan Creek. H. A. McClure, city engr.

Mich., Detroit—City having estimates made paving 4 mi. Livernois Ave. from Tireman Ave. to northern city limits, asphaltic concrete. C. W. Hubbel, city engr.

Ill., Carlinville—Comrs. Macoupin Co. having plans prepared building Springfield-St. Louis Rd., 16-18 ft. wide, brick or concrete. About $160,000. H. E. Bilger, Springfield, rd. engr. Noted Dec. 13, 1917.

Ill., Edwardsville—Comrs. Madison Co. having plans prepared building 9-10 mi. Alton-St. Louis Rd., 18 ft. wide, brick. About $277,000. W. E. Holden, co. supt. highways. Noted Jan. 31.

Ill., Geneva—Comrs. Kane Co. receive bids in spring building Lincoln Highway, west of Elburn, 16 ft. wide, brick or concrete. About $93,100 available. M. J. Tarble, co. supt. highways.

Ill., Rockford—Comrs. Winnebago Co. soon receive bids building 6¾ mi. Grant Highway, from Rockford to Cherry Valley Twps., 16-18 ft. wide, brick and concrete. About $146,000 available. A. R. Carter, co. supt. highways.

Ill., Springfield—Comrs. Sangamon Co. having preliminary surveys made building Springfield-Beardstown Rd. and South 6th St. Rd., 16-18 ft. wide, brick or concrete. About $132,500 each. E. H. White, co. supt. highways.

Minn., Tracy—City receives bids in March paving 25 blocks in business section, 44 ft. wide, residential section, 36 ft. wide, concrete. About $75,000. J. W. Shaffer, New York Life Bldg., Minneapolis, engr.

Streets and Roads (Continued)

Kan., Topeka—Comrs. Shawnee Co. receive bids in February building 9.85 mi. Topeka-Lawrence Co. Rd., 18 ft. roadway, 2 course concrete, 2 in. top course on 6 in. base. J. E. Williams, Topeka, engr.

Mo., St. Louis—City plans to issue $354,000 bonds to build new sidewalks in parks, new roads and repair roads. E. R. Kinsey, pres. bd. pub. serv.

Okla., Hominy—City plans to pave various streets. About $100,000.

Oregon—State Highway Comn., Salem, having plans prepared by H. Nunn, engr., for road work as follows: 7 mi. road from Polk Co. line to Corvallis, $129,500; 9 mi. road from Monroe to Junction, $166,500; 9 mi. road from Jefferson to Albany, $166,500; 1 mi. rock road from first crossing south of Goshen to 2nd crossing, $6000; 4 mi. road from Walker to Cottage Grove, $74,000; 5 mi. from Winchester to Roseburg, $92,500; 10.4 mi. road from Yoncalla to Oakland, $72,800; 12.8 mi. rock road from Myrtle Creek to Dillard, $76,800; 5.8 mi. rock road from Wolf Creek to Grove Creek, $34,800; 6 mi. road from Grants Pass to Jackson Co. line, $105,000; 5 mi. road, Siskiyou Sect., Central Point, N., $92,500; 12½ mi. road in Marshfield, south, $250,000; 8.1 mi. road from Multnomah Co. line to Hillsboro, $149,850; 5 mi. road from Newberg to West Dayton, $92,500; 5 mi. road from Tillamook Co., $92,500; 5 mi. road from Astoria to Warrenton, $92,500; Overhead Comstock, $10,000; 5 mi. road in Wasco Co., $92,500; 9 mi. road from La Grande to Hot Lake, $166,500; 14 mi. rock road from Haines to Baker, $844,000; rock road from Hood River to Mosier, $175,000; rock road, Divide Crossing, $16,000; 14 mi. gravel road, Wasco Co., $84,000; 8 mi. gravel road, Sherman Co., $48,000; 10 mi. gravel road, Gilliam Co., $60,000; 24 mi. gravel road, Morrow Co., $130,000; 30 mi. gravel road, Umatilla Co., $180,000.

Ore., Marshfield—State Highway Comn. appropriated $250,000 building 12½ mi. roads between Marshfield and Coquille.

Cal., Fresno—Bd. Supervs. Fresno Co. plans to issue $5,000,000 bonds to build highways. C. Jorgensen, chn. bd. supervs.

Cal., Modesto—City will sell $15,000 bonds to improve various streets. Plans include grading and paving with asphaltic concrete, curbing, guttering.

Ont., Orillia—Town receives bids in spring for about 5 mi. asphalt paving, concrete curbs and storm sewers. About $150,000. James, Loudon & Hertzberg, Ltd., Excelsior Life Bldg., Toronto, engrs. Noted Dec. 12.

BIDS DESIRED

Virginia—Until Dec. 31, by G. P. Coleman, comr. state highway dept., Richmond, building 4.08 mi. gravel road between Cabin Point and Burrowsville, Surry and Prince George Counties.

Tex., Bay City—Until Jan. 14, by A. Lee, aud., Matagorda Co. for (1) dredging and delivering on wharf at Matagorda (a) 10,700 cu.yd. mudshell (b) 13,700 cu.yd. mudshell; (2) hauling and placing on Matagorda-Big Hill Rd., (a) 10,700 cu.yd. mudshell (b) 13,700 cu.yd. mudshell. No bids received on Oct. 18. Noted Oct. 3.

Ariz., Holbrook—Until Jan. 6, by County Highway Comn., building 4½ mi. Snowflake Rd. from sand of present road to Coleman and Payne Ranch, involving 2000 cu.yd. earth excav., 3500 cu.yd. gravel surfacing, 60 cu.yd. rubble paving, 10 cu.yd. rubble masonry and 75 ft. culvert pipe; 3½ mi. Snowflake Rd. from Coleman and Payne Ranch to bridge, involving 18,000 cu.yd. earth excav., 3500 cu.yd. gravel surfacing, 120 cu.yd. rubble paving, 15 cu.yd. rubble masonry and 72 ft. culvert pipe; also placing 900 cu.yd. gravel surfacing on Holbrook-St. Johns Rd., ½ mi. east of Little Colorado River. W. E. Ferguson, secy.

Wash., Seattle—Until Jan. 6, by Comrs. King Co., grading and graveling 3252 ft. Boddy-Hindle Rd., 20 ft. wide. About $15,000. Project includes building trestle and wharf and involves 5000 cu.yd. excav., 173,000 ft. lumber and 9000 lin.ft. piling, etc. Noted Oct. 3.

Cal., Riverside—Until Jan. 8, by Bd. Supervs., building Indio-Coachella Rd., involving 1033 cu.yd. Class "A" concrete paving, 7.4 cu.yd. Class "A" concrete (Ford), 543 cu.yd. excav. and 4145 lin.ft. shaping roadbed; alternate bids will be received for 66,940 sq.ft. 5 in. oil-macadam paving. A. B. Pelch, clk.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★**Pa., Pittsburgh**—City let contract grading, paving and curbing Guckert Way, to T. Cronin, 17th and Muriel Sts. and Booth & Flinn, 1942 Forbes St. About $186,300.

★**Minn., St. James**—City let contract paving 20 blocks of streets, business section, 44 ft. wide, residential section, 36 and 40 ft. wide, residential section, to J. McLaughlin & Sons, c/o Minnesota Pipe & Tile Co., Mankato. About $100,000.

★**Tex., Austin**—Defined Rd. Dist. No. 1, Travis Co., let contract for 114,083 sq.yd. surfacing on Middle Buster Highway No. 29, to Finley Method Co., 703-4 Stewart Bldg., Houston; grading and graveling, to McMillen & Williamson, Hutto; 1023 sq.yd. concrete for drainage structures, to F. Dozier, Austin. Noted Nov. 21.

★**Okla., Chickasha**—Grady Co. let contract building 11 mi. road, to W. R. Palmer, Frederick. About $14,000.

★**Washington**—State Highway Comn., Olympia, let contract surfacing 6 mi. Central Washington Highway, between Connell and Pasco, Franklin Co., crushed gravel, to H. C. Root, 525 Madison St., Spokane. $21,580. Work involves 8300 cu.yd. gravel. Noted Dec. 5.

★**Wash., Ritzville**—Comrs. Adams Co. let contract grading, draining and surfacing 8½ mi. Highway Impvt. No. 104, 28 ft. wide, orushed rock, to T. Goodenough, Hatton, $54,997. Work involves 24,000 cu.yd. earth excav. and 17,100 cu.yd. rock excav. Noted Oct. 31.

★**Wash., Seattle**—Bd. Pub. Wks. let contract filling and paving Holgate St., et al, to Stewart Constr. Co., Amer. Bank Bldg., $37,678. Work involves 62,250 cu.yd. earth excav., 3490 sq.yd. concrete on 6 in. concrete base.

Railways

PROPOSED WORK

Connecticut—Waterbury & Bristol Tramway Co., 144 Bank St., Waterbury, plans to extend electric car line from South St., Bristol over Wolcott St. and through Wolcott connecting with car line from Waterbury to Hotchkiss Lake. Address J. H. Cassidy, 144 Bank St., Waterbury.

Pennsylvania—Montour R. R., Oliver Bldg., Pittsburgh, purchased site consisting of 25 acres in Coraopolis and Robinson Twps., Allegheny Co., which it plans to use for yards and future car manufacturing plant. E. H. Knight, Coraopolis, asst. ch. engr.

California—Southern Pacific Ry., Flood Bldg., San Francisco, plans to grade and build spur line, 23½ mi. long, from Calipatria to point near Holtville. W. Hood, ch. engr.

Excavation and Dredging

PROPOSED WORK

Fla., Bradentown — Drainage — Comrs. Manatee Co. soon let contract building drains in Pierce Saw-Grass D. D., also drains and laterals to be known as Oneco Public Drain and Laterals. W. Taylor, clk. Noted Oct. 3.

La., Lake Charles—Drainage—Sulphur D. D. No. 3 voted $125,000 bonds for drainage work. T. H. Mandell, engr.

Ia., Logan—Drainage—Comrs. Harrison Co. (Logan) and Monona Co. (Onawa), receive bids in January building Upper Willow Creek D. D. No. 2. Work includes 11.66 mi. main ditch and laterals and involves 520,786 yds. excav. J. M. Albertsen, aud. Noted Nov. 7.

Mo., St. Louis—Reclamation—See "Miscellaneous."

Tex., Beaumont—Dredging, etc.—C. L. Scheree, city engr., soon receives bids for 12,000 yd. dredging and building 500 ft. concrete quay wall.

Idaho, Camas—Irrigation—Camas Mutual Irrigation Dist. voted $675,000 bonds to build system to irrigate 20,637 acres of land.

BIDS DESIRED

N. Y., Albany—Barge Canal Works—Until Jan. 14, by W. W. Wotherspoon, supt. pub. wks., extending core wall and other work at north end of Dam No. 2, Seneca Falls, Sect. 1, Cayuga and Seneca Canal, Contr. T; drilling holes in sill of dam and toe of river wall of lock near Rotterdam and making necessary repairs, Sect. 2, Erie Canal, Contr. No. 197; furnishing and installing two 3 ton electric semi-portal revolving jib cranes on Pier 6, East River, New York City. Contr. No. 102; advertised in this issue.

S. C., York—Ditches—Until Jan. 15, by Comrs. Turkey Creek D. D. No. 1, building 26 mi. dredged ditches in York and Chester Counties. Project involves 861,860 cu.yd. excav. W. D. Alexander, Charlotte, N. C., engr. Former bids rejected. Noted Nov. 28.

Ind., Greenfield—Drain—Until Jan. 11, by C. Boone, co. engr., building W. L. Cook et al Drain, Brown Twp., Hancock Co. (Greenfield) and Madison Co. (Anderson). Work involves 24,680 ft. 4-24 in. tile, etc.

Minn., New Ulm—Ditch—Until Jan. 15, by L. G. Vogel, aud., Brown Co., building Judicial Ditch No. 6, in Brown Co., (New Ulm) and Watonwan Co. (St. James). Work includes main open ditch 19,785 ft. long, 1 open lateral, 2500 ft. long, etc., and involves 4233 cu.yd. excav., 7435 ft. 6-36 in. clay or cement tile, etc. C. N. Robertson, engr.

Wash., Seatle—Excavation—See "Streets & Roads."

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

N. Y., New York—Dredging—Comr. Docks & Ferries, Pier A, foot Battery Pl., North River, received only bid Dec. 23, dredging about 20,000 cu.yd. at southerly side of Pier No. 64, foot of West 24th St., North River, from P. S. Ross, 277 Washington St., Jersey City, N. J. About $19,000. Noted Dec. 19.

★**Ga., Atlanta**—Excavation—City let contract for 33,500 cu.yd. excav. for coagulating basin, to Nichols Contg. Co., Trust Co. of Georgia Bldg. About $30,000.

★**Minn., Olivia**—Ditch—Renville Co. let contract building Judicial Ditch No. 16, involving 45,700 cu.yd. open ditch, 8400 ft. 8 ft. bottom, 36,400 ft. 10 ft. bottom, 179,325 ft. of 5-24 in. tile, bulkheads consisting of approximately 1 ton of reinforced steel rods, 60 cu.yd. concrete, 22 corrugated pipes, 16 ft. long, 9-30 in. diameter; Judicial Ditch No. 21, involving 32,100 ft. 6-22 in. tile, to C. A. Walb, La Grange, Ind., $119,466. Noted Dec. 5.

★**Wash., Ritzville** — Excavation — See "Streets and Roads."

Industrial Works

PROPOSED WORK

R. I., Providence—L. B. Darling Fertilizer Co., 327 Canal St., receives bids in spring building 2-story, rein.-con. storage and machine shop and 11 x 18 ft. elevator tower on Smithfield Ave. About $25,000 and $2000 respectively. Former bids rejected. Noted Dec. 5.

N. Y., Brooklyn—Circle Garage Co., 250 Coney Island Ave., will receive bids in January building 1-story, 50 x 200 ft., rein.-con., steel and brick garage, rein.-con. flooring, concrete foundation, on Coney Island Ave. and Prospect Park West. About $45,000. Shampan & Shampan, 772 Bway., archts.

N. Y., Brooklyn—B. A. Cushman Co., 772 Nostrand Ave., having plans prepared for 3-story, 45 x 85 ft., steel and brick bakery, concrete foundation, Sterling Pl. and Nostrand Ave. About $55,000. C. D. Cooley, archt., Century Bldg., Pittsburgh, Pa., receives bids in February for project.

N. Y., New York—M. Groh's Sons, 238 West 28th St., having plans prepared by Friedman, Robertson & Keeler, archts., 90 West St., for 10-story, 75 x 100 ft. steel and brick cold storage warehouse, rein.-con. flooring, concrete foundation. About $250,000.

N. Y., Niagara Falls—Pub. Serv. Comn., 2nd Dist., granted permission to Niagara Falls Power Co. to issue $2,000,000 bonds; proceeds will be used to build addition to power house No. 3.

N. J., Jersey City—City Comn. plans to build 2-story, brick and concrete boiler and engine room on City Hospital Grounds. About $50,000.

N. J., Newark—E. I. du Pont de Nemours & Co., Du Pont Bldg., Wilmington, Del., had plans prepared for 1-story, 100 x 120 ft., brick and steel addition to plant on Vanderpool St. and Ave. B. About $45,000. C. K. Weston, Wilmington, Del., publicity agt.

N. J., Newark—E. and H. Levy, 4th Ave. and 19th St., had plans prepared by F. A. Phelps, archt., 920 Union Bldg., for 4-story, 52 x 213 ft. and 40 x 46 ft., brick and rein.-con. silk mill and power house on Purdy and O'Dell Sts. About $75,000.

N. J., Westfield—Kling Furniture Co., Mayville, had plans prepared for 1-story, 64 x 500 ft. factory adjoining New York Central R. R. here. About $30,000.

Industrial Work (Continued)

Pa., Phila.—W. Sellers & Co., Inc., 1000 Hamilton St., had plans prepared building, 5-story, 55 x 100 ft. rein.-con. plant.

Pa., Pittsburgh—Ward Baking Co., 3100 Liberty Ave., having preliminary sketches prepared by C. B. Comstock, archt., 110 East 40th St., New York City, for 4 story, 175 x 500 ft., steel and brick bakery, concrete foundation, Penn Ave. and Putnam St. About $1,000,000.

Md., Elkton—Scott Fertilizer Co. considering tentative plans for rebuilding plant. About $250,000.

Va., Norfolk—Norfolk Glass Mfg. Co., 564 Church St., considering plans for 1- and 2-story plant near Berkley St. consisting of 4 buildings. About $200,000.

Ala., Mobile—Mobile Shipbuilding Co. purchased 16 acre site here on which it plans to build shipbuilding plant.

O., Toledo—S. S. Royster Guano Co., 2nd Natl. Bank Bldg., has purchased 5 acre site adjoining its plant and plans to build sulphuric acid plant. About $500,000.

Mich., Bessemer—See "Buildings."

Mich., Grand Rapids—Furniture Manufacturers' Assn., 216 Lyon St., N. W., plans to build 2½-story warehouse on Fulton St., W., 30,000 sq.ft. space on each floor. About $150,000.

Mich., Howard City—Gillett Motor Truck Products Co. had plans prepared for 1-story, 65 x 200 ft. steel factory.

Ill., Chicago—Philipsborn Outer Garment Co., 900 West Van Buren St., has had plans prepared by A. S. Alschuler, archt., 28 East Jackson St., for 8-story, 150 x 200 ft. brick and rein.-con. factory, rein.-con. flooring and concrete foundation, on Harrison and Paulina Sts. About $1,250,000. Noted Apr. 4.

Wis., Fond du Lac—Galloway-West Co., 24 West Division St., had plans prepared by R. E. Mehner, archt., Fond du Lac, building 3-story, 148 x 170 ft. rein.-con. condensory, cheese factory and garage, also 125 ft. concrete shack.

Wis., La Crosse—Gibson Bros., 1115 Caledonia St., plans to build brick and concrete ice cream factory. About $25,000.

Wis., Milwaukee—Standard Oil Co., Brumder Bldg., receives bids in spring building brick, rein.-con. and steel garage on 32nd St., cost $50,000; also distributing station on Barclay St., $150,000. Schlinz & Bailey, 53 West Jackson Blvd., Chicago, engrs.

Wis., Watertown—Globe Milling Co., 320 West Water St., receives bids in spring building 2-story, 30 x 150-ft. warehouse. G. E. Mausho, mgr.

Mo., St. Louis—Pedigo Weber Shoe Co., 3433 Locust St., soon receives bids building 6-story, 50 x 150 ft. factory on Locust and Theresa Sts. About $85,000.

Tex., Dallas—Dallas Motor Car Co., 2018 Commerce St., plans to rebuild plant destroyed by fire. Loss, $150,000.

Tex., Ft. Worth—Peden Iron & Steel Co., 700 North San Jacinto St., Houston, purchased site on South Main St here, and plans to build large plant.

Tex. La Porte—P. Hughes and others acquired site on ship canal near here and plan to build oil refinery, 600 bbl. initial capacity.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★**N. Y., Brooklyn**—Ideal Constr. Co. 292 Rogers Ave., will build 1-story, 100 x 100 ft., steel and brick garage, rein.-con. flooring, concrete foundation, at 200-206 Emerson Pl. About $25,000. Work will be done by day labor.

★**N. Y., Brooklyn**—Pohl-Abbott Constr. Co., 200 Montague St., will build 1-story, 120 x 131 ft., steel and brick garage, rein.-con. flooring, concrete foundation, Ocean Ave. and Ave. N. About $35,000. Work will be done by day labor.

★**N. J., Trenton**—See "Miscellaneous."

★**Md., Baltimore**—D. B. Martin Co., Claremont Stock Yards, Brunswick St. and Wilkins Ave., let contract building 2-story, 16 x 30 ft., brick and timber addition rein.-con. flooring, rock and concrete foundation, also altering present plant, to Consolidated Eng. Co., 243 Calvert Bldg. About $55,000.

★**Md., Hagerstown**—See "Miscellaneous."

★**Md., Sparrows Point**—**Bethlehem Steel** Co. let contract to Deverill, Spencer & Co., 514 Garrett Bldg., Baltimore, building roof on proposed 1-story, 73 x 1070 ft., concrete, steel and brick steel plate mill, rein.-con. flooring, concrete foundation, cost $50,000; also slag screening tower, 24.7 ft. high on concrete foundation surmounted by steel house, 15 ft. high, cost, $85,000. Owners will build mill by day labor. Cost between $150,000 and $200,000. Noted Sept. 5.

★**Va., Newport News**—Wilkins & Robinson Co., Inc., 218 23rd St., let contract building 3-story, 50 x 100-ft. brick warehouse at 215 23rd St., to C. C. Vellines, 25th St. and Roanoke Ave. About $25,000.

★**Wis., Menasha**—Gilbert Paper Co. let general contract building 60 x 120 ft. power house, to C. R. Meyer & Sons Co., 50 State St., Oshkosh; steel, to Truscan Steel Co., 216 West Water St., Milwaukee. About $50,000.

★**Tex., Ft. Worth**—Baltic Refining Co. let contract building refinery, to Bryce Bldg. Co., 909 Throckmorton St. About $750,000.

★**Cal., Corona**—Exch. Byproducts Co. let contract building 2-story, brick and timber acid house, rein.-con. flooring, concrete foundation, to Oresmer Mfg. Co., Riverside. About $30,000. Noted Dec. 12.

Buildings

PROPOSED WORK

R. I., Woonsocket—Fire House—City receives bids in spring building 3-story, brick and concrete, rein.-con. flooring and concrete foundation on North Main St. About $75,000. W. F. Fontaine, Federal Bldg., archt.

Conn., Bridgeport—Lodge, etc.—E. G. Southey, archt., 983 Broad St., receives bids in spring building 3-story brick and concrete, concrete foundation, on Stratford Ave., for Sons of St. George, c/o archt. About $100,000.

Conn., Waterbury—School—Bd. Educ. will issue $225,000 bonds to build 2½-story grammar school on Elm St.

N. Y., Brooklyn—School—St. Gregorys congregation, Brooklyn Ave. and St. Johns Pl., plans to build 3-story, 40 x 135 ft., steel and brick, concrete foundation. About $80,000. Helmle & Corbett, 190 Montague St., archts.

N. Y., Rockaway — Theater — Zenith Amusement Co., 1579 Bway., New York City, had plans prepared by T. W. Lamb, archt., 644 8th Ave., New York City, for 1-story, 103 x 150 ft., steel and brick, concrete foundation, on Boulevard west of Maneoke Ave. About $100,000. Noted Dec. 19.

N. Y., Utica—Hospital—Masonic Order, 46 West 24th St., New York City, having preliminary plans prepared by H. P. Knowles, archt., 52 Vanderbilt Ave., New York City, for 2 or 4 story, brick here. Cost between $400,000 and $1,000,000.

Pa., Chester—Business College—J. Sleeper, 625 Welch St., had preliminary plans prepared by F. C. Watson, archt., 625 Welch St., for 3-story, 42 x 110 ft., brick, 613-615 Welch St. About $50,000.

Pa., McKees Rocks—Church—St. Mary's congregation soon receives bids building 1-story, 50 x 100 ft. brick, on Helen and Ella Sts. About $600,000. J. H. Philips, 604 Chartiers Ave., archt.

Pa., Valley Forge—Memorial Church—Valley Forge Memorial Com. plans to build 1-story. About $100,000. C. C. Harrison, 400 Chestnut St., Phila., chn. Zantzinger, Borie & Medary, Otis Bldg., Phila., archts.

N. C., Sedalia—Institution—Palmer Memorial Institute plans to build. About $50,000. Address C. H. Brown.

O., Akron—School—Bd. Educ., South Forge St., having preliminary plans prepared by F. R. Ridley, archt., Cottage Pl., building 2- or 3-story Normal School on West Exchange and Bowery Sts. About $250,000.

O., Akron — School — Bd. Educ., South Forge St., having plans prepared by T. R. Ridley, archt., Cottage Pl., for 2-story addition to Mason School on Beaver St., and 2-story addition to Lincoln School on West Crosier St. About $125,000 each.

O., Cleveland—Infirmary—Ohio Bd. Administration, Columbus, will submit budget to Governor asking for appropriation of $100,000 to build at Cleveland State Hospital.

O., Columbus—Dormitory—Ohio Bd. Administration will submit budget to Governor asking for appropriation of $100,000 to build at Columbus State Hospital.

O., Columbus—Office—Luthol Co., Ruggery Bldg., having plans prepared by O. Miller, archt., 619 N. T. Natl. Bldg., building 7-story, 43 x 66 ft. brick, steel and rein.-con., rein.-con. flooring and concrete foundation on Oak St. About $95,000.

O., Dayton—Church and School—Holy Family congregation, Monmouth St., having plans prepared by Murphy & Jaekle, archts., Union Bank Bldg. About $100,000.

O., Dayton—Hospital—Ohio Bd. Administration, Columbus, will submit budget to Governor asking for appropriation of $100,000 for hospital at Dayton State Hospital.

O., Dayton—Store—L. Traxlor Co., Main St. Arcade, having plans prepared by Schenck & Williams, archts., Mutual Home Bldg., for 6 story, 140 x 145 ft. rein.-con. and terra-cotta, rein.-con. flooring and concrete foundation.

O., Delaware—Cottage—Ohio Bd. Administration, Columbus, will submit budget to Governor asking for appropriation of $50,000 to build cottage at Girls' Industrial School here.

O., Gallipolis—Hospital—Ohio Bd. Administration, Columbus, will submit budget to Governor asking for appropriation of $100,000 to build at institution for epileptics and $250,000 for 10 cottages.

O., Lancaster—School—Ohio Bd. Administration, Columbus, will submit budget to Governor asking for appropriation of $50,000 to build 2 wing additions to Boys Industrial School here.

O., Marysville—Cottages—Ohio Bd. Administration, Columbus, will submit budget to Governor asking for appropriation of $160,000 to build at State Reformatory for Women here.

O., Mt. Vernon—Hospital—Ohio Bd. Administration, Columbus, will submit budget to Governor asking for appropriation of $50,000 to build at State Sanitarium here.

Mich., Bessemer—School—Bd. Educ. receives bids about Feb. 1, building 2 story, brick and rein.-con. school and power house. About $125,000. C. Anderson, Ironwood, archt.

Mich., Crystal Falls—Hotel—C. A. Robinson had plans prepared by D. Hubert, archt., Menominee, for 3-story brick. About $50,000.

Mich., Detroit—High School—Bd. Educ. had plans prepared by Malcolmson & Higginbotham, archts., 404 Moffat Bldg., for 2-story, 90 x 160 ft. brick, rein.-con. and steel, rein.-con. flooring and concrete foundation on Duboise St. between J St. and Waterloo Ave. About $250,000.

Mich., Detroit—Hospital—**Pub.** Welfare Com., Macomb and St. Antoine St., having plans prepared by J. Scott & Co., archts., 2326 Dime Bank Bldg., building 2 wing additions and administration buildings to Receiving Hospital here. About $250,000. Noted Oct. 17.

Mich., Detroit—Schools—Bd. Educ. having plans prepared by Malcolmson & Higginbotham, archts., 404 Moffat Bldg., building school on Thornton and Ivanhoe Aves., cost, $240,000; Georgia and Concord Sts., $160,000; Cass Technical on Beach and Jones Sts., $2,000,000.

Mich., Flint—Hotel—Citizens Hotel Co. receives bids about April 1, building 6-story, rein.-con. covering 12,500 sq.ft. floor space, on Detroit and Saginaw Sts. About $700,000. Esenwein & Johnson, Ellicott Sq., Buffalo, N. Y., archts. Noted Apr. 11.

Ill., Chicago—Bank—U. S. Federal Reserve Bank has purchased 160 x 165-ft. site on La Salle and Jackson Sts. and plans to use same for future building. Property now occupied by Counselman, Gaff, Old La Salle St. Trust & Savings Bank and Royal Insurance Co. Bldgs. New structure will be delayed until expiration of existing 3-yeatr lease.

Ill., Chicago—Office—C. Rubens, c/o A. S. Alschuler, archt., 28 East Jackson St., plans to build 268 x 290 ft. on Harrison and Congress Sts. About $1,000,000.

Ill., Chicago—Theater—Ascher Bros., 220 South State St., has purchased 105 x 198 ft. site on 92nd St. and Commercial Ave. and plans to build moving picture theatre. About $250,000. H. Newhouse, 4630 Prairie Ave., archt.

Buildings (Continued)

Ill., Chicago Heights—Club—Chicago Heights Country Club having preliminary plans prepared by P. Gerhardt, archt., 64 West Randolph St., Chicago, for 4-story, 75 x 150 ft. brick and rein.-con., rein.-con. flooring and concrete foundation on Illinois and Oak Sts. About $150,000.

Wis., Hartford—Office—Kissel Motor Car Co. had plans prepared for 4-story brick. About $50,000.

Wis., Jefferson—Sanitarium—Comrs. Jefferson Co. receive bids in spring building 2 and 3 story, 100 x 150 ft., brick, rein.-con. and steel, rein.-con. flooring and concrete foundation. About $75,000. F. C. Edwards, Ft. Atkinson, chn. O. C. Uehling, 1st Natl. Bank Bldg., Milwaukee, archt.

Wis., West Allis—High School—R. Messmer & Bro., archts., 221 Grand St., Milwaukee, receives bids in January for 3-story, 176 x 277 ft., rein.-con. and steel, rein.-con. flooring and concrete foundation on National and 67th Sts., for Bd. Educ., Milwaukee. About $360,000.

Minn., St. Paul—Hospital—Cobb Hospital Assn., 2056 Iglehart Ave., had plans prepared by L. Bassindale, archt., Capital Bank Bldg., building hospital. About $400,000.

Kan., Beloit—School—Bd. Educ. having preliminary plans prepared by W. Sayler, archt., 2638 Olive St., Kansas City, Mo., for brick and rein.-con. About $100,000. Noted Oct. 17.

Neb., Omaha—Hotel—T. J. O'Brien Co. plans to build 6-story, 40 x 132 ft. addition to Henshaw Hotel, 1509 Farnam St.

Mo., St. Louis — College — Christian Brothers' College soon lets contract for brick and concrete on Clayton Rd. About $200,000. H. P. Hess, 4811 Cote Brilliante Ave., archt. Noted May 16.

Mo., St. Louis—Public Buildings—Bd. Pub. Serv. recommended by City Plan Comn., H. Batholomew, engr., to issue $15,000,000 bonds for building group of public buildings facing City Hall and Municipal Courts Bldgs. E. R. Kinsey, 301 City Hall, pres.

Tex., Bonham—Church—First Baptist congregation soon receives bids building 2-story, 96 x 124 ft., hollow tile. About $60,000. N. F. Marsh, 211 Bway., Central Bldg., Los Angeles, Cal., archt.

Colo., Colorado Springs—Bank—First Natl. Bank, Court Pl. and Colorado Ave., plans to build 16-story. About $500,000.

Ariz., Phoenix—Temple—Masonic Order having plans prepared by Lescher & Kibbey, archts., Bank of Arizona Bldg., building 3-story, 120 x 140 ft., rein.-con. and brick to be known as El Zabira Temple. About $150,000.

Cal., Los Angeles—School—Bd. Educ., 730 Security Bldg., plans to build on 7th St. About $75,000. W. D. Sheldon, secy.

Cal., San Bernardino—City Hall—City plans election April to vote on $150,000 bonds to build city hall.

Cal., San Francisco—Home—University of California plans to build nurses' home at University Hospital. About $160,000.

Que., Ste. Anne de Bellevue—Chapel, Mortuary, etc.—R. C. Desrochers, secy. Dept. Pub. Wks., Ottawa, Ont., soon lets contract building chapel, mortuary, stable and garage at Military Hospital here.

Ont., Toronto — Hospital — Dept. Pub. Wks., Ottawa, soon lets contract building recreation building and officers' hospital at Military Orthopedic Hospital here.

Ont., Windsor—School—Bd. Educ., La Belle Bldg., purchased site on Giles Blvd. and Langlois Ave. and plans to build 10-room school. About $80,000.

BIDS DESIRED

Ga., Lyons—Court House—Until Jan. 6, by Comrs. Toombs Co. rebuilding court house destroyed by fire. About $50,000. A Blair, Georgia Life Bldg., Macon, archt. Noted Dec. 27.

Ind., Culver—Library—Until Mar. 15, by A. Knell, archt., 5661 Natural Bridge Rd., St. Louis, Mo., building 2-story, 100 x 160 ft. library building on Campus here for Trustees of Culver Military Academy, 5661 Natural Bridge Rd., St. Louis, Mo. About $75,000. Noted Dec. 12.

Mich., Detroit—School—Until Jan. 9, by Bd. Educ., 50 Bway., building 2-story, 102 x 223 ft. brick, rein.-con. and steel, rein.-con. flooring and concrete foundation on Emerson Ave., south of Jefferson Ave. About $275,000. Malcolmson & Higginbotham, 404 Moffat Bldg., archts.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

★**Mich., Detroit**—War Service Bldg.—War Work Council, 600 Lexington Ave., New York City, let contract building 2-story, 44 x 150 ft., brick and steel war service center building, concrete foundation, St. Aubin Ave. and Grand Blvd., to R. H. Howe Constr. Co., 105 West 40th St., New York City. About $100,000. Noted Nov. 21.

★**Ill., Chicago**—Office—Morris & Co., 38 South Dearborn St., let contract building 5 story, 96 x 162 ft. rein.-con. on 42nd and Loomis Sts., to R. C. Wieboldt, 1534 West Van Buren St. About $300,000.

★**Mo., Kansas City**—Club—Kansas City Club, 12th and Wyandotte Sts., let contract building 14-story, steel, to Kansas City Structural Steel Co., 705 Orear-Leslie Bldg. About $275,000.

★**Ont., Toronto**—Hospital Wards—Dept. Pub. Wks., Ottawa, let contract building five 2 story hospital wards here, to Quinlan & Robertson, Ltd., 260 St. James St., Montreal, Que.

★**Man., Winnipeg**—Home—Dept. Pub. Wks., Ottawa, Ont., let contract building convalescent wards, long active treatment ward, etc., in Soldiers' Home, to Carter-Halls-Aldinger Co., 1010 Union Bank Bldg. About $1,000,000. Noted Sept. 26.

Federal Government Work

PROPOSED WORK

Mass., Boston—Wharf—U. S. Eng. Office, Boston, rejected all bids received Sept. 30, building pile wharf at Nahant, same being in excess of appropriation. Noted Sept. 5.

Conn., Bridgeport—Dredging and Repairing Breakwater—U. S. Govt. plans to dredge and repair breakwater of Bridgeport Harbor, deepen channel, etc.

BIDS DESIRED

N. Y., New York—Altering Lobby—Until Jan. 10, by J. A. Wetmore, superv. archt., treas. dept., Wash., D. C., altering south lobby and east corridor in post office here; advertised in this issue.

Va., Portsmouth—Altering Post Office—Until Jan. 15, by J. A. Wetmore, superv. archt., treas. dept., Wash., D. C., altering post office here.

Fla., Key West—Deepening Harbor—U. S. Eng. Office, Jacksonville, receiving bids for removing portion of middle ground in Key West Harbor to make depth of 26 ft. Work involves about 230,000 cu.yd. rock excav. J. M. Braxton, Jacksonville, engr.

O., Canton—Altering Post Office—Until Jan. 7, by J. A. Wetmore, superv. archt., treas. dept., Wash., D. C., altering post office here.

Ind., Shelbyville—Post Office—Until Jan. 20, by J. A. Wetmore, superv. archt., treas. dept., Wash., D. C., building here.

PRICES AND CONTRACTS AWARDED

(★Indicates award of contract)

Conn., Bridgeport—Altering Post Office—J. A. Wetmore, superv. archt., treas. dept., Wash., D. C., received bids Dec. 13, altering post office here, from Casey & Hurley, 120 Pequock St., $7845; E. Diebietsch, 383 Madison Ave., New York City, $7939; Schwarz Bros. Co., 95 River St., $8012. Noted Dec. 5.

★**D. C., Wash.**—Railways—U. S. Housing Corp., Wash., will build 1258 ft. 8 in. single track line laid on double track on 17th St., N. W., between H St. and Penn. Ave. for Washington Ry. & Electric Co., who will eventually purchase line. About $125,000. Work will be done by day labor. Noted Dec. 12.

★**Utah—Salt Lake City**—Hospital—Constr. Div., War Dept., Wash., D. C., let contract building at Ft. Douglas, to Lynch-Cannon Eng. Co., Dooly Bldg. About $130,000.

Miscellaneous

PROPOSED WORK

Machinery—Bridgeport, Conn.—Bd. Contr. & Supply plans to purchase 2 street cleaning machines, $6100 each; 1 sewer well cleaner, $7500. J. A. McElroy, city engr.

Parks—New Britain, Conn.—City plans to issue $300,000 bonds to improve parks. Work involves buildings, pools, dykes, large swimming pool, trees, shrubbery, etc.

Signal and Tower Station—Newark, N. J.—Lehigh Valley R. R., 143 Liberty St., New York City, plans to build 2-story interlocking signal and tower station here. About $10,000. G. T. Hand, New York City, ch. engr.

Retaining Walls—Toledo, O.—City plans to expend $65,000 for timber and $83,000 for concrete retaining walls in connection with extension of Summit St. across Swan Creek. H. A. McClure, city engr.

Park — Belleville, Ill. — City and War Camp Community Serv. Bd. having plans prepared for F. J. Kern, chn.

Playgrounds, Parks—St. Louis, Mo.—City plans to issue $5,626,000 bonds to build playgrounds and parks to include landscape gardening, greenhouses, shaping grounds, equipment of playgrounds, wading pools, stables, bandstands, boat houses, locker building, etc. E. R. Kinsey, pres. bd. pub. serv. Noted Nov. 21.

Riverfront Improvements—St. Louis, Mo.—City Plan Comn. submitted report to Bd. Pub. Serv. recommending $25,000,000 bond issue for riverfront improvements. Plans include building railroad terminals to cost between $3,000,000 and $5,000,000; freight yards, houses and connections with Free Bridge, cost, $3,00,000; also reclaiming lowlands for industrial use. H. Bartholomew, city engr.

Quay Wall, etc.—Beaumont, Tex.—See "Excavation & Dredging."

Drydock—Astoria, Ore.—Comrs. Port Astoria having plans prepared building floating drydock to have capacity of 15,000 tons; cost about $100,000. Comrs. also plan to build import and export pier. A. Bartlett, engr.

Dyke—Los Angeles, Cal.—City Harbor Comrs., City Hall, having plans prepared by J. W. Ludlow, harbor engr., City Hall, San Pedro, building rock dyke at Fish Harbor for reclamation of 140 acres tidelands. About $80,000. Noted Oct. 24.

BIDS DESIRED

Sand, etc.—Jersey City, N. J.—Until Dec. 31, by Dept. Parks and Pub. Impvts., furnishing and delivering sand, lime, cement, etc. About $10,000.

Wharf, etc.—Seattle, Wash.—See "Streets & Roads."

PRICES AND CONTRACT AWARDED

(★Indicates award of contract)

Auto Eductor, Steam Roller, etc.—Brooklyn, N. Y.—E. Riegelmann, pres. Brooklyn Boro., received bids Dec. 18, furnishing and delivering (a) 1 auto eductor for Bureau of Sewers (b) 1 steam asphalt roller (c) 6 back dumping dirt trucks (d) 2 tar melting and gravel heating trucks, from Otterson Auto Eductor Co., 817 Fairbanks Bldg., Springfield, O., (a) $8000; Good Roads Machy. Co., 50 Church St., New York City (b) $2580; Shadbolt Mfg. Co., 68 Flushing Ave. (c) $3900; C. Hvass & Co., Inc., 509 East 18th St., New York City, (d) $1180. Noted Dec. 12.

Semi Trailers—Brooklyn, N. Y.—E. Riegelmann, pres. Brooklyn Boro., received only bid Dec. 20, furnishing and delivering 4 semi trailers for Bureau of Highways, from Shadbolt Mfg. Co., 68 Flushing Ave., $5000. Noted Dec. 12.

Steam Roller—New York, N. Y.—H. Bruckner, pres. Bronx Boro., received only bid Dec. 18, furnishing and delivering one 5-ton steam asphalt roller, from Good Roads Machy. Co., 50 Church St., $3000. Noted Dec. 12.

Shaft—New York, N. Y.—Pub. Serv. Comn., 49 Lafayette St., received bids Dec. 23, completing shaft No. 2 of Route No. 26, Queensboro Subway Rapid Transit R. R. on East 42nd St., from Rice & Garey, 2786 Bainbridge Ave., $99,085; J. O'Leary, 929 Peace St., Pelham Manor, $99,300; Powers, Kennedy Contg. Corp., 149 Bway, $110,000. Noted Dec. 12.

★**Wharf and Freight Shed—Trenton, N. J.**—City let contract building 1-story, 90 x 200 ft. wharf and freight shed on Ferry St., to N. A. K. Bugbee, 206 East Hanover St. About $60,000.

★**Swimming Pools—Hagerstown, Md.**—Y. M. C. A. let contract excavating and building 2 concrete swimming pools in proposed 4-story, 73 x 190 ft. concrete and brick building, to J. R. Ricketts, Hagerstown. Bids for building will be received about Jan. 30.

★**Pumping Machinery—Greenville, Miss.**—Black Bayou D. D. let contract furnishing and installing 2 drainage pumps with combined capacity of 80,000 g.p.m. against low heads, also supplementary machinery and appurtenances, to A. M. Lockett & Co., 533 Baronne St., New Orleans, La. About $34,408. Noted Oct. 17.

★**Tunnel—San Francisco, Cal.**—Western Sugar Refinery, 60 California St., let contract building tunnel on 23rd and Louisiana Sts., to Healy-Tibbets Constr. Co., 9 Main St. About $15,000.

SEARCHLIGHT SECTION

PROPOSALS

Bids: Jan. 7.

Canal Improvements

STATE OF NEW YORK, OFFICE OF SUPERINTENDENT OF PUBLIC WORKS

Albany, December 6th, 1918.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, January 7th, 1919, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of 1903, and of the acts amendatory thereof and supplementary thereto, and Chapter 570 of the Laws of 1915, as follows:

—1—

CONTRACT NO. 191.

Erie Canal—Section 9.

For excavating the canal channel in the Genesee river south of the temporary dam near Elmwood avenue bridge.

Length about 0.62 mile. Sheets 1 to 5 inclusive.

—2—

CONTRACT NO. 192. (Readvertisement)

Erie Canal—Section 9.

For completing the canal from the east guard-lock to the Genesee river, and the work in Genesee Valley park.

Sheets 1 to 28, inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bond required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y.; at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division, at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or New York, issued by a national or state bank in good credit within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

Official Proposals

Price, $3.60 an inch—Copy can be received until Tuesday, 10 a.m., for issue out Thursday.

The publication of an advertisement on this page is an official notice that bids are wanted from other than local bidders.

It is also a guarantee that maximum competition is invited because Engineering News-Record is the *one* nationally recognized medium for Proposal advertising. Its Searchlight Section is read each week by nearly every worth-while contractor in this country who bids on public work outside his own city.

PROPOSALS

The bond required for the faithful performance of each contract shall be in such sum as shall be fixed by the Superintendent of Public Works, which sum shall not be less than twenty per centum (20 per cent.) of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work, according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds, co-insurance only will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the state for doing the work and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned the interests of the state will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.

U. S. ENGINEER OFFICE, Custom House, New Orleans, La. Sealed proposals will be received here until 11 a.m., December 30, 1918, and then opened, for deepening a portion of the present existing Intracoastal Waterway between the Calcasieu River, La., and the Sabine River, La. and Texas. Further information on application.

PROPOSALS

Bids: Jan. 6.

Advertising $100,000 Contract Concrete Culverts

Tulsa, Okla.

Sealed bids will be received by the Board of County Commissioners of Tulsa County, Oklahoma, on Jan. 6, 1919, until 2 o'clock P.M., in the County Court House of Tulsa, Oklahoma, for the construction of the following described culverts:

Mile 6, Sec. D, 4′ x 3′ x 26′ Concrete Culvert (Standard).
Mile 6, Sec. R, Concrete Box 4′ x 3′ x 24′ (Standard).
Mile 6, Sec. R, Concrete Box 4′ x 3′ x24′ (Standard).
Mile 4, Sec. M, Concrete Culvert 8′ x 4′ x 24′ (Standard).
Mile 4, Sec. M, Concrete Culvert 8′ x 4′ x 24′ (Standard).
Mile 4, Sec. L, Concrete Culvert 8′ x 4′ x 37′ (Standard).
Mile 4, Sec. L, Concrete Culvert 6′ x 4′ x 42′ (Standard).
Mile 4, Sec. L, Concrete Culvert 6′ x 4′ x 42′ (Standard).
Mile 1, Sec. L, 3′ x 6′ x 15′ extension to culvert.
Mile 2, Sec. L, 10′ x 3.5′ x 8′ extension to culvert.
Mile 4, Sec. K, 25′ of 30″ Vitrified tile, Concrete H. W.
Mile 4, Sec. K, 25′ of 30″ Vitrified tile, Concrete H. W.
Mile 3, Sec. K, 25′ of 30″ Vitrified tile, Concrete H. W.
Bt. Sec. 28 & 33, T, 21, R, 13, 36′ x 16′ steel concrete Br. Steel to be furnished by county.
Bt. Sec. 20 & 29, T, 21, R, 13, 30′ x 16′ steel concrete Br. Steel to be furnished by county.
Mile 1, Sec. H, 9′ extension and wings, to 2′ x 3′ box culvert.
Mile 2, Sec. H, 4′ x 4′ x 26′ Concrete Culvert (Standard).
Mile 3, Sec. H, 5′ x 7′ x 3′ extension to Concrete Culvert.
Mile 5, Sec. H, 3′ x 3′ x 24′ Concrete Culvert (Standard).

The Commissioners reserve the right to reject any and all bids, all bids to be accompanied by a certified check covering 10% of bid. Plans and specifications are now on file in the office of the County Engineer in Tulsa, Oklahoma.

BY ORDER OF THE BOARD OF COUNTY COMMISSIONERS
By LEWIS CLINE.
County Clerk.

Bids: Jan. 2.

Pumping Unit

Galesburg, Ill.

Sealed bids will be received by the City Clerk of the City of Galesburg, Ill., until 5 o'clock P.M. Monday, Jan. 2, 1919, for Deep Well Pumping Unit. Detailed information may be obtained at the office of F. M. Connolly, City Engineer.

The City of Galesburg reserves the right to reject any and all bids.

By order of City Council.

WM. L. BOUTELLE.
City Clerk.

PROPOSALS

Bids: Jan. 14.

Canal Improvements

STATE OF NEW YORK, OFFICE OF SUPERINTENDENT OF PUBLIC WORKS

Albany, N. Y.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Tuesday, January 14th, 1919, at which place and hour they will be publicly opened and read, for improving the Cayuga and Seneca canal pursuant to the provisions of Chapter 391 of the Laws of 1909, and Chapter 147 of the Laws of 1903, and amendatory laws, and for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of 1903, and of the acts amendatory thereof and supplementary thereto, and Chapter 570 of the Laws of 1915, as follows:

—1—

CONTRACT "T"

Cayuga and Seneca Canal—Section 1.

For extending the core wall and other work at the north end of Dam No. 2, Seneca Falls.

Sheets 1 and 2.

—2—

CONTRACT NO. 197.

Erie Canal—Section No. 2.

For drilling holes in the sill of the dam and the toe of the river wall of the lock, near Rotterdam, and making necessary repairs.

Sheets 1 and 2.

And for the construction of Barge canal terminals pursuant to the provisions of Chapter 746 of the Laws of 1911, and of the acts amendatory thereof, as follows:

—3—

TERMINAL CONTRACT NO. 102.

For furnishing and installing two three-ton electric semiportal revolving jib cranes on Pier 6, East river, New York City.

Contract plans, sheets 1 to 17 inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or New York, issued by a national or state bank (or trust company in the case of terminal contract, in good credit within the state and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The bond required for the faithful performance of each contract shall be in such sum as shall be fixed by the Superintendent of Public Works, which sum shall not be less than twenty per centum (20 per cent.) of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds co-insurance only will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the state for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner in the judgment of the undersigned, the interests of the state will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.

Dec. 13, 1918.

Bids: Jan. 6.

Road Work

Tulsa, Okla.

Sealed bids will be received by the Board of County Commissioners of Tulsa County, Oklahoma, on Monday, January 6, 1919, until 2 o'clock in the County Court House of Tulsa, Oklahoma, for the construction of the hereinafter described roads; such roads to be graded and brought to the established grade, preparatory to the future hard surfacing of the same.

Section of State Road	Miles in Length
....."Y".....	....."6".....
....."H".....	....."6".....
....."K".....	....."4".....
....."L"..(Mi. 4-5 & 6)	....."3".....
....."N".....	....."5".....
....."D".....	....."7".....
....."A"..(Mi. 1 & 2)	....."2".....

The Commissioners reserve the right to reject any and all bids, all bids to be accompanied by a certified check covering 10% of bid. Plans and specifications are now on file in the office of the County Engineer of Tulsa, Oklahoma.

BY ORDER OF THE BOARD OF COUNTY CAMMISSIONERS OF TULSA COUNTY
LEWIS CLINE,
County Clerk.

PROPOSALS

Bids: Dec. 30.

Water-Works Bonds

NOTICE OF BOND ISSUE AND SALE BY THE CITY OF TUCUMCARI, QUAY COUNTY, NEW MEXICO

Tucumcari, New Mexico.

Public notice is hereby given that the City Council of the City of Tucumcari, in the County of Quay, State of New Mexico, intend to issue, negotiate and sell negotiable Coupon Bonds of said City in the amount of $5,000 (five thousand dollars) Waterworks Bonds.

Said bonds will bear date August 15th, 1918, and will be redeemable at the option of said City twenty (20) years after date, and be absolutely due and payable thirty years after date, bearing interest at the rate of 6% per annum.

The City Council of the City of Tucumcari, New Mexico, will meet on the 30th day of December A. D., 1918, at the hour of one o'clock p.m., for the purpose of considering bids. The said Council reserves the right to reject any and all bids offered. No bids will be considered that are conditioned in any way. All bids must be accompanied by cash or an unconditional certified check for the amount of bid, which check is to be forfeited in case said bidder does not comply with the terms of this advertisement.

The bonds are to be sold by the City Council of said City for cash only to the highest and best bidder, and in no case for less than their par value and accrued interest to date of delivery.

THE CITY COUNCIL OF THE CITY OF TUCUMCARI, NEW MEXICO.
By M. R. James, Mayor.
Attest: E. F. Dunn, City Clerk.

Bids: Jan. 2.

Draw Span and Girder

New Brunswick, N. J.

Notice is hereby given that sealed bids will be received by the Board of Chosen Freeholders of Middlesex County, N. J., for the construction of a Strauss Trunnion Bascule Draw Span and concrete encased girder approach spans over the Delaware and Raritan Canal on Albany Street, New Brunswick, N. J., and opened and read in public at Freeholders' Rooms, County Record Building, New Brunswick, N. J., at 2.30 p.m., on Thursday, January 2, 1919.

Drawings, specifications and forms of bid are on file in the office of Alvin B. Fox, County Engineer, at Perth Amboy, N. J., and may be inspected by prospective bidders during business hours.

Bidders will be furnished with a copy of the specifications and blue prints of the drawings by the engineer on proper notice and payment of $10.00 deposit which deposit will be refunded upon return of the plans and specifications in proper condition. Bids must be made on the proposal forms furnished by the engineer in the manner designated therein and required by the specifications must be enclosed in sealed envelopes, bearing the name and address of the bidder on the outside, addressed to the Board of Chosen Freeholders of Middlesex County, N. J., and must be accompanied by a certified check for not less than Three Thousand Dollars and be delivered at the place on or before the hour above named. The standard proposal form will be furnished on application.

By order of the Board of Chosen Freeholders of Middlesex County, N. J.
ALVIN B. FOX,
County Engineer.

PROPOSALS

Bids: Jan. 9.

Sewer System and Sewage Disposal Plant

Globe, Arizona.

Bids will be received up to 12 o'clock noon, January 9th, 1919, by the Mayor and Common Council of the City of Globe, Arizona, for the construction of sanitary sewers and a sewage disposal plant as per plans and specifications prepared by Benham Engineering Company, consulting engineers, Oklahoma City, Oklahoma, approved and on file in the office of the City Clerk, Globe, Arizona.

The sanitary sewers consist of approximately eighteen miles of sewer lines varying in sizes from six (6) to eighteen (18) inches, and varying in depth from zero (0) to twelve (12) feet. There are approximately 280 manholes, 12 drop manholes, 22 flushtanks and 76 lampholes. Alternate bids are asked for vitrified clay and concrete sewer pipe.

The sewage disposal plant consists of two reverse flow Imhoff Tanks, two sludge beds and chlorinator house with the necessary excavation.

Bids are asked for on the unit price basis and must be made out on proposal blanks furnished by the engineers. Certified check from a bank in the State of Arizona in amount of ten thousand ($10,000) dollars must accompany bid, as an evidence of good faith to insure the signing of the contract and the filing of the required bonds.

The contractor will receive cash in payment for the work from money now in the City Treasury.

Plans and specifications can be procured upon the payment of ten dollars ($10) at the office of the Benham Engineering Company, consulting engineers, 13th Floor, Colcord Bldg., Oklahoma City, Oklahoma, or may be examined at the office of the City Clerk, Globe, Arizona.

The City reserves the right to reject any and all bids.

Dated this 6th day of December, 1918.

CITY OF GLOBE, ARIZONA.
By J. F. MAYER,
City Clerk.

Bids: Jan. 31.

Water-Works System and Filter Plant

Poteau, Okla.

Sealed proposals will be received at the office of the City Clerk, up to 8 o'clock P.M., January 31st, 1919, for all of the labor, material, equipment and machinery necessary to install a complete water works system and filter plant, for and to be owned by the City of Poteau, Oklahoma, and marked "Proposal for Water Works," with the name and address of the bidder on the outside of the envelope.

The work will consist of approximately the following:

One Brick Pumping Station
One Brick Filter House
One Sedimentation Basin
One Pure Water Reservoir
Two One Hundred Horse Power Boilers
Two High Service Pumping Engines
Three Steam Engine or Turbine Driven Centrifugal Pumping Units
Two Duplex Boiler Feed Pumps
One Condenser and Air Pump
Steam and Water Piping
Filter Equipment for Two Tanks
One Concrete Overfall Dam
Three and One Half Miles Cast Iron Pipe, Valves, Hydrants.

The plans and specifications are on file and may be seen at the office of the City Clerk, Poteau, Oklahoma, or may be obtained from the Engineer, J. E. Davis, Poteau, Oklahoma, by depositing $10.00 for same; said sum will be returned on receipt of a bona fide bid accompanied by the plans and specifications.

Each bid must be accompanied by a certified check for 5 per cent. (5%) of the amount of bid, payable to the City Treasurer.

The City reserves the right to reject any and all bids.

Dated: Poteau, Oklahoma, December 6th, 1918.

C. M. BAGWELL,
Mayor.

Attest:
A. W. LINDSEY, City Clerk.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., December 16, 1918.—Sealed proposals will be opened in this office at 3 p.m., January 10, 1918, for alterations in south lobby and east corridor of the United States Post Office building at New York, N. Y. Drawings and specifications may be obtained from the Supervising Chief Engineer, 741 Custom House, New York, N. Y., or at this office, in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., December 23, 1918.—Sealed Proposals will be opened in this office at 3 p. m., January 23, 1919, for the construction of the United States Post Office at Russellville, Ark. Drawings and specifications may be obtained from the custodian of the site at Russellville, Ark., or at this office, in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

SEALED PROPOSALS will be opened by the Lighthouse Superintendent, Detroit, Mich., 2 o'clock p.m., December 30, 1918, for constructing boilers for the Lighthouse Tender Amaranth. Information upon application to the above office.

Engineering News + Engineering Record
ENGINEERING NEWS-RECORD

Circulation Over 34,000 Weekly

The Largest of Any Technical Paper in the World

Progressive Contractors, Manufacturers and Dealers everywhere read the Proposal pages of Engineering News-Record, looking for opportunities to bid on work to be done or supplies to be furnished. A few dollars invested for publicity in this

One Nationally-Recognized Medium

for Proposal Advertising, will bring competition from reliable organizations and compel local bidders to figure closer.

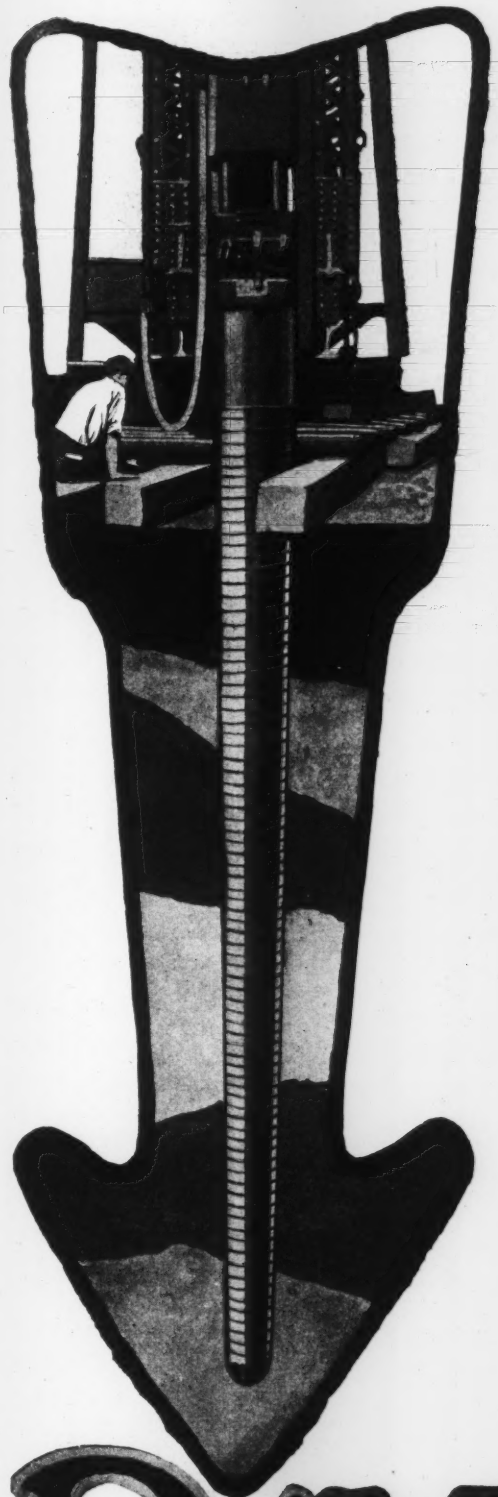
Large Savings on contracts invariably result. The cost of placing your Proposals where they will be seen by about every one in the entire country who would be interested in them is only $3.60 an inch a week.

Plans and Specifications, for the convenience of bidders, may be filed in our offices in New York, Philadelphia, Cleveland, Chicago, San Francisco or Salt Lake City without extra charge.

No work is too small; none too large, to be beyond the money-saving influence of advertising in Engineering News-Record.

Over 3,000 contracts advertised in Engineering News-Record in one year.

The publication of an advertisement for bids in the Engineering News-Record is an official notice that bids are wanted from other than local bidders. It is also a practical guarantee that maximum competition is invited.



Get down to FACTS on concrete pile formation—

As a matter of fact, the most important element in the formation of a concrete pile is to be absolutely ***certain*** that the concrete pile column is perfect, in length, taper and quality of concrete. Otherwise the whole argument for concrete piles falls to pieces. Now, in Raymond Concrete Piles

the Shell is left in the ground—

the shell into which the concrete is poured—a spirally reinforced steel "form" which perfectly resists ground pressure and admixture of foreign materials. Thus, every Raymond Concrete Pile must be perfect, for the interior of each driven shell may be inspected after the driving core is withdrawn and before concrete is poured. Every Raymond Pile is an accomplished fact.

Raymond Concrete Pile Company

New York
140 Cedar St.

Chicago
111 W. Monroe St.

Branches in Principal Cities

Raymond Concrete Pile Co., Ltd., Montreal, Canada

A Form for every Pile—A Pile for every Purpose

RAYMOND

SHOWING a New Milburn lighting up a big construction job on the Atlantic seaboard.

No. 8
Over 8000 Candle Power
Burn 12 hours on 8 lb. of Carbide
Costs 3½c. per hour to operate.
Send for Circular No. 21

NEW MILBURN

"The Light That Never Fails"

CHEAPER: Because it burns ordinary lump carbide that costs only $5.00 per drum of 100 lb. anywhere! Also burns cake carbide—but why pay $6.50 per cwt. for carbide that gives 1/3 less gas than common carbide!

BETTER: Because it radiates the greatest volume of light. Keeps the job as bright as day. Saves labor and trouble—as it never gets out of order and tank doesn't require re-filling with water at every charging.

New Milburns have been ordered and re-ordered many times by such firms as Stone & Webster Co., Westinghouse, Church & Kerr Co., American Construction Co., Fred T. Ley & Co., etc., etc.,—simply because in all cases and at all times they have proved to be by far the best and most economical lights on the market.

On sale by Supply Dealers and Agents everywhere.

We'll gladly send you one on trial—just to show you!

OXY-ACETYLENE APPARATUS

"Milburn" Generators, Portable Plants, Torches, Welding and Cutting Outfits have been used by the leading concerns for a dozen years. They are standard on over 100 U. S. fighting ships and in the Navy Yards. Send for Circular 31.

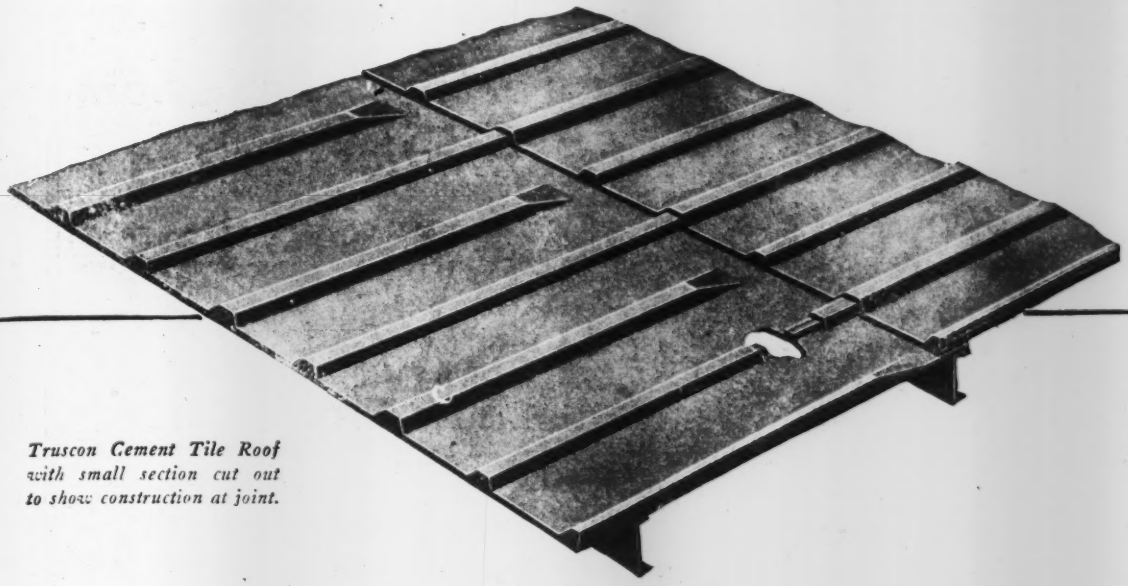
The "Cut-Weld" — a combination torch for both cutting and welding. You simply change the Tips!!

The Alexander Milburn Co.

Baltimore, U. S. A.

New York 51 E. 42d St. | Chicago 1012 Kimball Bldg. | Boston 79 Milk St. | Pittsburgh 406 Bessemer Bldg. | Washington 711 13th St., N. W.

Agents Everywhere



Truscon Cement Tile Roof with small section cut out to show construction at joint.

The Clean-Cut Lines of Truscon Cement Tile Roofs

The distinctive design of Truscon Cement Tile adds architectural beauty to any building. The straight surfaces, meeting at sharp angles, form clean-cut lines of light and shade and give the roof a particularly attractive appearance.

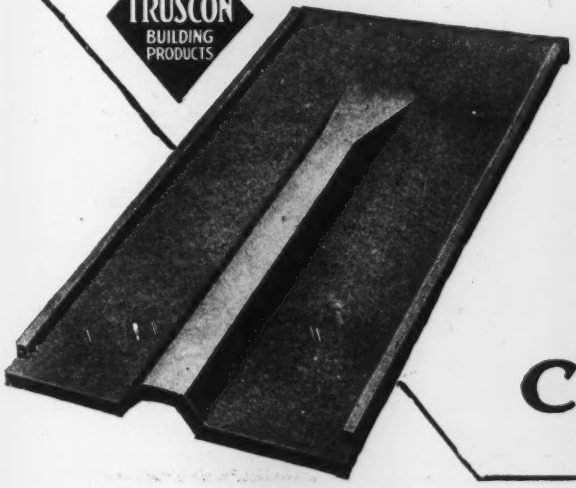
Truscon Cement Tile are factory made under ideal conditions. Only the best concrete materials and reinforcements are used. The red coloring of the top of the tile is integral and permanent. All tile are properly seasoned and inspected.

The light weight, fireproofness and economy of Truscon Cement Tile make it an ideal roof for factories, industrial buildings, etc.

We furnish all types of tile for both sloping and flat roofs. **Prompt shipment** is now being made from our Detroit factory and warehouse stock.

Send for cement tile pamphlet and estimates.

TRUSCON STEEL CO. TRUSCON BUILDING PRODUCTS



TRUSCON STEEL COMPANY
(FORMERLY TRUSSED CONCRETE STEEL CO.)
YOUNGSTOWN, OHIO.
WAREHOUSES AND REPRESENTATIVES IN PRINCIPAL CITIES

TRUSCON
REINFORCED
CEMENT TILE

Get Ready NOW for the Big Boom
Send for Information on

CHAPMAN VALVES

"CHAPMAN QUALITY COSTS NO MORE"

PEACE has come with its countless blessings sooner than we thought. American industry, quickly mobilized for the strenuous prosecution of the war, stripping off every non-essential, will even more speedily turn to the arts of peace.

The lessons of the Big War will exercise a tremendous influence upon American industry. A big job was tackled in a big way and completed in true Yankee style. In the Big Boom that's surely coming, the knowledge of the task well done will instill new confidence and bigger ambitions.

Get ready NOW for construction and reconstruction activities. Send for data on CHAPMAN VALVES.

Send for our complete Catalog. You'll find it almost invaluable when preparing plans and specifications.

The Chapman Valve Mfg. Co.

Indian Orchard, Mass.

Branch Offices and Agents with Stock:

Boston Chicago New York Philadelphia San Francisco

72 in. List 58½ Flange End Double Gate Valve Stationary Spindle with Bevel Gear and Indicator.

P&H

On City Streets

where work must be done with uniformity and dispatch the P & H Combination—Excavator, Backfiller and Tamper—is the logical equipment for the job.

Excavation—steady and fast with none of the irregularity of human labor and at a cost that means actual profits.

Backfilling—getting the ground back in a hurry on *one* man's time.

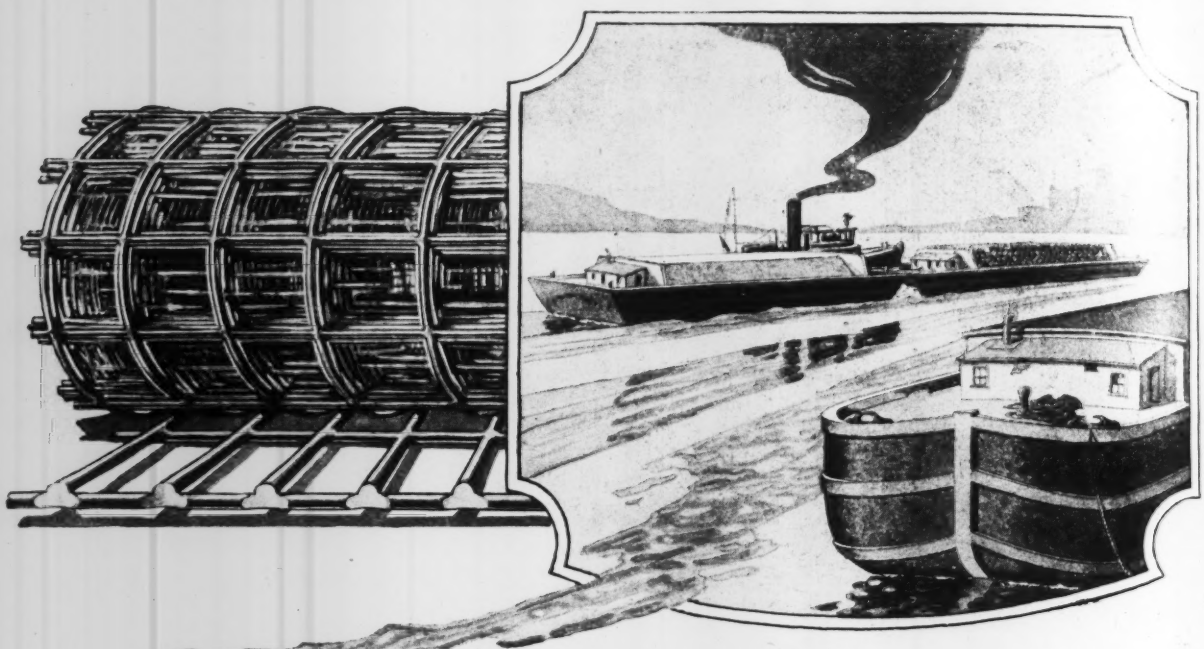
Tamping—finish up a good job by ramming the backfill back to stay with no danger of settling pavements later.

But this is speaking rather generally, as we realize; we'll be glad to "show you" real facts and figures just as soon as you're ready for them.

P & H Excavator—Bulletin No. IX
P & H Backfiller—Bulletin No. 9X
P & H Tamper—Bulletin No. 8C

PAWLING & HARNISCHFEGER CO.

Milwaukee, Wisconsin



"Mules of the Sea"

Barges and scows get the hardest knocks of all sea-going craft. They are built for that. The best barges and scows are now built of reinforced concrete. In both, Clinton Welded Fabric is used for the "skin," reinforcing because it makes the perfect *bond*. That's due to the Clinton Electrical Weld.

The Clinton Electrical Weld is the joint that makes two pieces of special grade galvanized steel wire *one*. The mesh of Clinton Wire Fabric is *rectangular*, without loops, twists, curls or soldering. There is no displacement. The joints *can't* come apart. Voids and cracking due to changes in temperature are reduced to a minimum. It stubbornly resists rust because the wire is thoroughly galvanized *before* welding.

The Clinton Weld is standing up in famous hotels, great railroad terminals, warehouses, factories and other industrial plants. It will serve you as well — permanently. Write today for a full description of the Clinton Electrical Weld and its manifold applications. It's a basic principle of good construction in modern building.

CLINTON WIRE CLOTH COMPANY

New York
Chicago

BOSTON

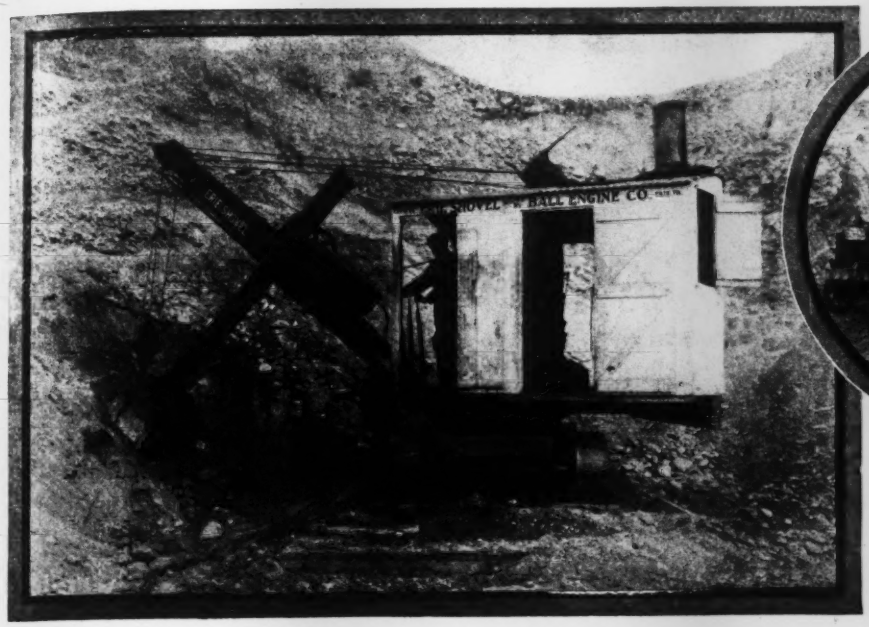
San Francisco:
Care L. A. Norris Co.

Manufacturers of Wire Cloth of every description, Nettings, Welded Wire Fabrics and Perforated Metals

Look for the Trade Mark
"CLINTON"
Reg. U. S. Pat. Off.
Our guarantee—your protection

CLINTON

Electrically Welded Wire Fabric



The two photos show a Type "A" ERIE Shovel owned by *P. COGGER, producer of crushed stone, sand and gravel; Lowell, Mass.*

In a recent letter, Mr. Cogger sums up his experience with this shovel:

"My Type 'A' ERIE Shovel has given me perfect satisfaction, and has done 50% more work than I expected. We are handling 300 cubic yards of gravel per day and the shovel is having an easy time."—*P. Cogger.*

Weighs only 13 tons, but has **plenty of Strength and Power**

It is a REAL steam-shovel—but weighs only 13 tons in working trim! Light enough to move around in the pit easily and quickly—

but powerful enough to dig cemented gravel or the lighter shales, without blasting.

The above photo shows a 13-ton "A" ERIE which is giving excellent results for P. Cogger, producer of crushed stone, gravel, and sand, Lowell, Mass. Read Mr. Cogger's letter above.

"A" ERIES are giving good service in gravel pits; excavating shale for brickyards; and on contracting work such as road grading, cellar excavation, trench digging, etc.

Type "A" ERIE Shovel

DIPPER CAPACITY. ½ CU. YD. 3 dippers fill a 1½ cu. yd. wagon or car. 4 dippers fill a 2-yd. car.

RATED CAPACITY: Deep cuts, 30 to 40 cu. yd. per hour. Shallow cuts, 15 to 25 cu. yd. per hour. (Type "A" ½-yd. ERIES have often exceeded this rated capacity).

EXCAVATES 28 FT. 4 IN. WIDE at floor level, with boom at 47½ deg. (Cut is wider if boom is lower).

EXCAVATES 46 FT. 4 IN. WIDE at 8 ft. height, with boom at 47½ deg. (wider if boom is lower).

DUMPS 13 FT. ABOVE FLOOR LEVEL, with boom at 47½ deg. (Higher dump if boom is raised).

BOOM HOIST. Quickly raises or lowers the boom to the most effective digging angle.

3-LEVER CONTROL, same as the Type "B" ¾-yd. ERIE.

FULL REVOLVING—will turn a complete circle.

TWO - SPEED TRAVELING GEAR, giving an average speed of 1 to 2 miles per hour on low speed, and 2 to 3 miles per hour on high.

IMPROVED POWER STEERING, using the same principle which has been so successful on the Type "B" ¾-yd. ERIE.

TRACTION WHEELS OR CAR WHEELS, interchangeable on the same truck frame.

Type "A" ½ yd. ERIE Shovel

It is rated to handle 30 to 40 cu.yds. per hour, but has done considerably more under favorable conditions.

It works steadily—in fact is absolutely dependable. Built along the same lines as our ¾-yd. Type "B" ERIE, of which there are more than 600 in service. The ½-yd. "A" is lighter, but weight considered is fully as good an excavator as the ¾-yd "B."

The first "A" ERIE has worked steadily for 18 months, and has given splendid service under all conditions, even with the thermometer 20° below zero.

Let us tell you where you can see a ½-yd. "A" ERIE in your locality. Write for a copy of our new Bulletin N-A. Address:

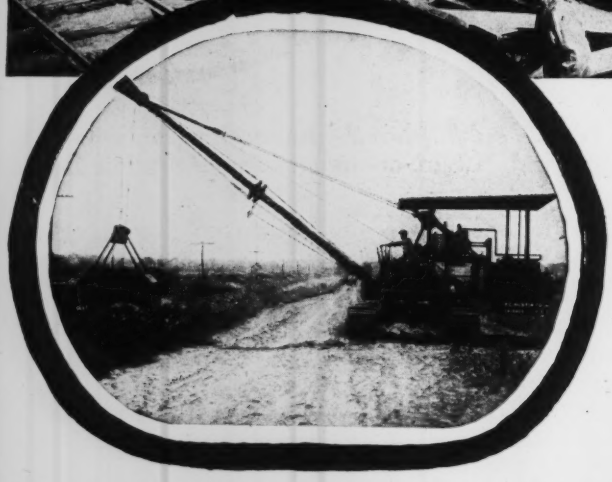
BALL ENGINE CO., Erie, Pa.

Builders of ERIE Steam Shovels and Locomotive Cranes; ERIE Railway Ditchers; BALL Engines.

ERIE Revolving Shovels BALL Engine Co. Erie, Pa.

AUSTIN

Forty Years of Knowing How Hammered Into Every Austin Machine



For nearly half a century Contractors everywhere have been using the Austin line because every machine can be depended upon o give satisfaction. These are two machines that have helped perpetuate the Austin reputation.

Austin Cube Pavers

Long life, freedom from minor ills and consequent repair expense are outstanding features of the Austin Cube Paver. It does its work quickly and perfectly. After years of use the inside wearing plates may be removed and replaced at slight cost, adding more years of satisfactory service.

Austin Combination Shovel, Skimmer, Dragline, Clamshell Bucket, Crane

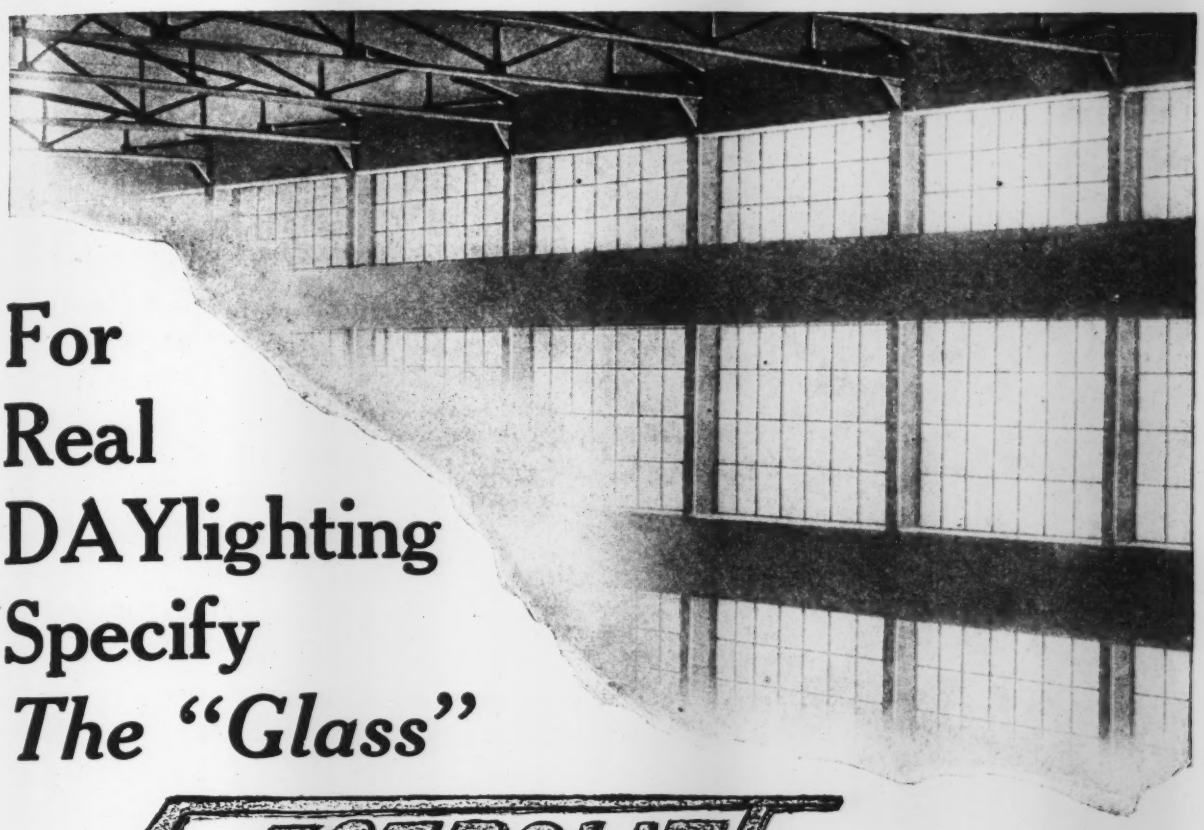
One ot the most versatile and popular machines of its line is shown equipped with ½-yard capacity bucket. As will be readily appreciated it has a wide range of usefulness. Thirty-foot radius self-propelling and handled by one man. Mounted on full swing turntable. Details in our catalog DL-103.

F. C. AUSTIN COMPANY, Inc.

Main Office: Railway Exchange, Chicago **New York Office: 30 Church St.**

MANUFACTURERS OF

TRENCHING MACHINES
BACKFILLERS
FARM TILE TRENCHERS
DRAGLINE EXCAVATORS
DRY LAND DIPPER DREDGES
LEVEE BUILDERS
MULTIPEDAL TRACTORS
WHEEL TRACTORS
WAGON LOADERS
CUBE CONCRETE MIXERS
CUBE PAVERS
CUBE HOT MIXERS
ASPHALT MIXERS
DRUM MIXERS
DRUM PAVERS
MOTOR FLUSHERS AND SPRINKLERS
MOTOR SWEEPERS AND SPRINKLERS
MOTOR ROAD OILERS
DITCHING MACHINES WITH BANK SLOPING ATTACHMENTS
DRAINAGE EXCAVATORS



For Real DAYlighting Specify *The "Glass"*

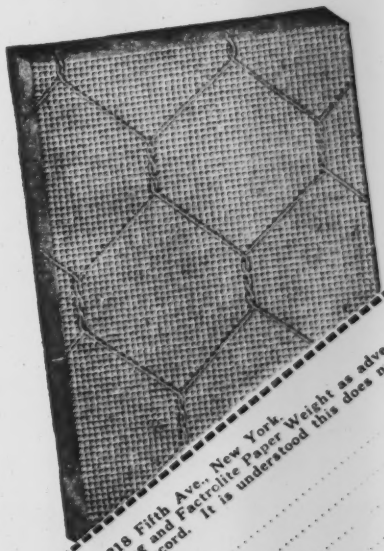
FACTROLITE

By **reflection** from the plane surface of ordinary glass a great deal of daylight is lost. The prismatic surface of FACTROLITE **GATHERS** these daylight rays that are ordinarily lost (particularly in confined locations where light strikes the panes at a narrow angle) and **diffuses** them indoors.

When direct sunshine strikes on windows glazed with "FACTROLITE," the workers do not have to work in a blinding glare or to hang blankets or shades to check the sunlight. FACTROLITE gives perfect diffusion that eases eye strain on the workers nearest the glass and gives those deep in the building interior a clear **diffused** daylight to work in.

The U. S. Government recently used over 100,000 square feet of "FACTROLITE" for daylighting a huge building 300 ft. x 700 ft. The engineers tell us that you cannot see a shadow in any part of the big structure.

FACTROLITE is made both in plain and wire glass. Test FACTROLITE in your own laboratory. **A free sample will be sent to engineers who use the coupon.**



The Mississippi Wire Glass Co.

218 Fifth Avenue, New York

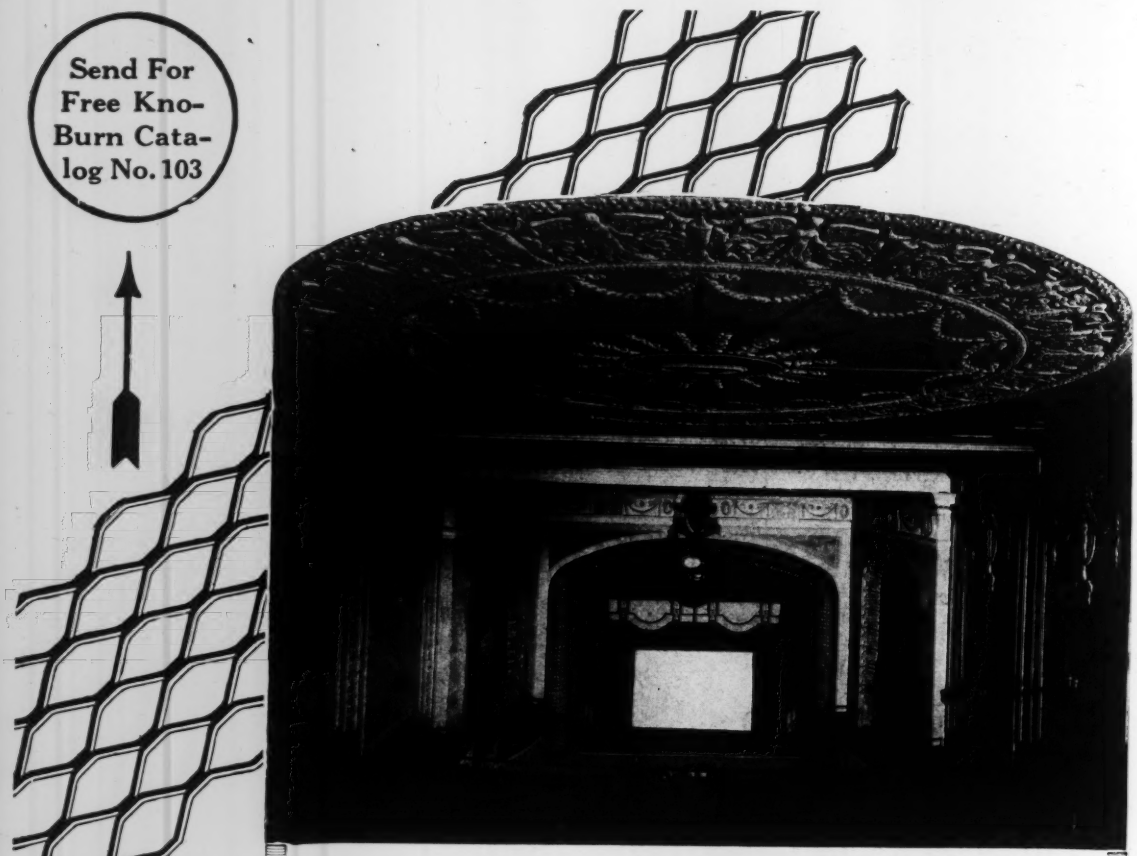
CHICAGO **ST. LOUIS**

Mississippi Wire Glass Co., 218 Fifth Ave., New York.
Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Engineering News-Record. It is understood this does not obligate me in any way.

Name .....

Address .....

Send For Free Kno-Burn Catalog No. 103



Ceilings Like This—

IN INTERIOR hotel, theatre, bank, etc., work, where elaborate decorative plaster effects are required, the work can be simplified and the expense reduced by using **KNO-BURN** Metal Lath supported by a light frame of small steel members, thus permitting the ornamental plastering to be cast right in place. This eliminates the necessity of a heavy supporting frame of non-fireproof material or of casting the decorations separately and fastening them to the structural members of the building.

KNO-BURN Metal Lath, the Most Satisfactory Plaster Supporting Material

"Kno-Burn" Metal Lath prevents cracking or discoloration of plastered walls and ceilings. It is fire resisting, rat proof, permanent and economical to use.

The lifting of the restrictions now makes it possible to obtain adequate stocks of "Kno-Burn" in all gauges in all principal cities. The name of your nearest distributor will be furnished on request.

Northwestern Expanded Metal Co.
900 Old Colony Building
CHICAGO

Kno-Burn

W. F. KEARNS CO. chose

Ransome

17 MIXERS TOWERS CHUTING PLANTS

The Boston Army Supply Base

now practically finished used this complete Ransome equipment while under construction.

W. F. Kearns Co., the contractors for this important government job chose Ransome equipment because it is always known to give efficient, economical and all-around satisfaction.

We shall be glad to tell you about other big jobs that Ransome Equipment helped to build.

Write for Bulletins.

Ransome Concrete Machinery Co.

Main Office and Works:

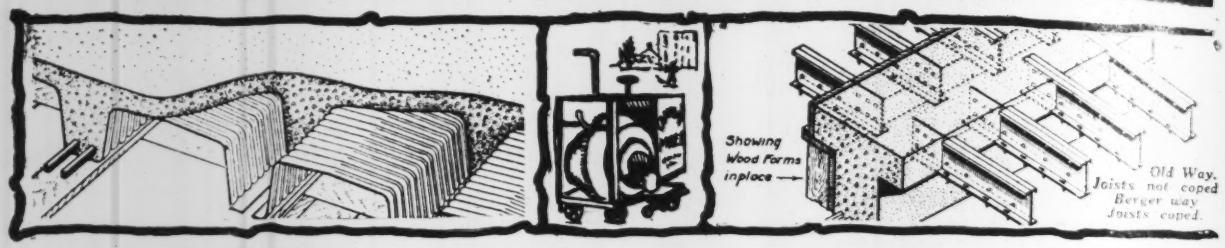
1750 Second Street, Dunellen, New Jersey

Branch Offices: Boston, New York, Chicago, San Francisco, Philadelphia, Atlanta

Agencies in All Principal Cities

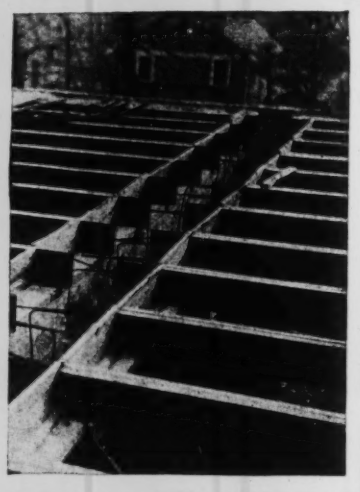
Manufacturers of Mixers, Pavers, Pneumatic Mixers, Chuting Plants, Hoist Buckets, Bins, Cars, Carts, Etc.

RANSOME



Floor-cores *Metal Lumber*

The Relation of Berger Produ



The Berger Manufacturing Co. have been specialists in sheet metal manufacture for more than thirty years. During this period they have done their full share in the designing and perfecting of sheet metal products for use in building construction.

FLOOR-CORES

These pressed steel forms supply the centering for a T-beam concrete floor in spans up to 35 feet and for live loads up to 200 pounds. Variations in depth and thickness are secured by wider spacing and by using the varying depth cores (4 to 14 in. high). Floor-core floors use every bit of concrete and reinforcing *efficiently*. They offer big advantages in strength, economy, rapid construction and ability to deaden sound and vibration.

METAL LUMBER

These joists and studs of pressed steel are light, one man material, made to order at the factory. Metal Lumber replaces wood with the advantages of fire-resistance, greater strength and freedom from warping, shrinking or destruction by insects. Berger originated Metal Lumber and the coping of the top flanges for use with concrete beams is a recent Berger improvement.

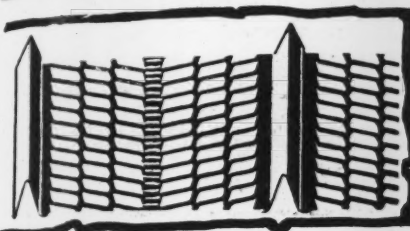
EXPANDED METAL PRODUCTS

Berger Expanded Metal is a well known standard reinforcement. Berger's Expanded Metal Lath is used as light reinforcement in concrete beam protection and in connection with column forms. It is also used over beams to prevent cracking of concrete and as reinforcement to guard against temperature cracks.

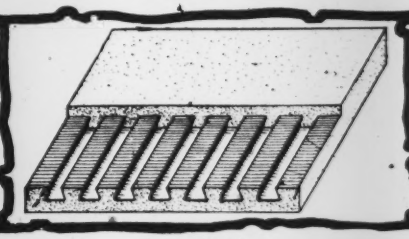
The Berger Mfg. Co.,

Branches: Boston New York Philadelphia
Export Dept.: Berger Bldg.,

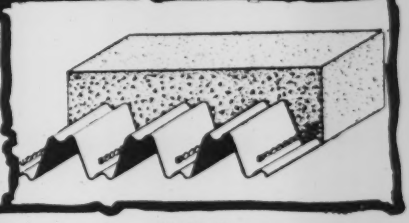
BERGER



Ribplex



Ferro-Lithic



Multiplex

cts and Concrete Construction

The Engineer finds several Berger products very useful in connection with various kinds of concrete construction. The paragraphs below characterize these products briefly. More complete information will be gladly supplied on request.

RIBPLEX

This is an expanded metal lath with $\frac{3}{4}$ inch ribs, which answers for both centering and reinforcement, in light concrete roofs, walls, floors and partitions. In many cases, too, the ribs take the place of furring and studding, while joists and studding can always be spaced wider when used with Ribplex.

FERRO-LITHIC

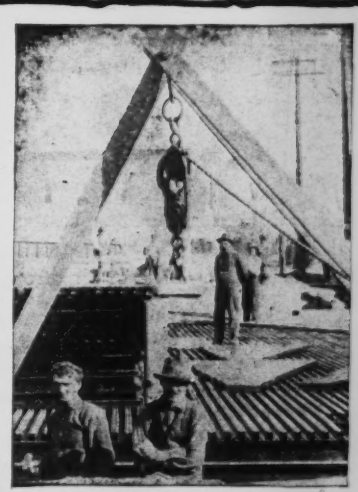
These plates are formed into a "dove-tail" fold, $\frac{1}{2}$, $\frac{5}{8}$ or $\frac{3}{4}$ inches in depth that gives a firm clinch above and below. Ferro-Lithic is used extensively for centering and reinforcing in roofs, siding and floors, in the lining of coal bunkers, in sidewalk construction and the like. Ferro-Lithic can be quickly put into place and forms a weather-tight job even without concrete.

MULTIPLEX

A heavy gauge metal, shaped into multiformed channels two to four inches in depth.

It is extensively used as reinforcement for heavy service floors, for powder mills, sugar refineries, and other places where a clean ceiling free from droppings of any kind is essential. It is also used in bridge floors.

Multiplex alone will carry heavy loads and it forms a substantial part of the finished floor, which is naturally formed into a series of steel supported concrete beams.



Write at once for samples, references, literature.

Canton, Ohio

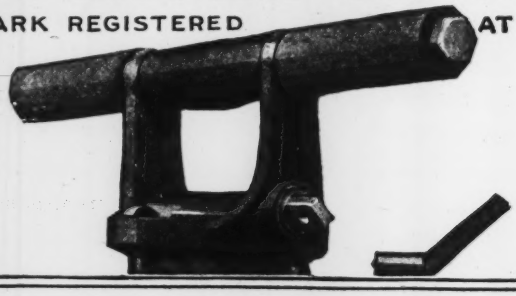
Chicago St. Louis Minneapolis San Francisco
New York, U. S. A.

FLOOR-CORES-REINFORCING PLATES
METAL LUMBER-EXPANDED METAL LATH

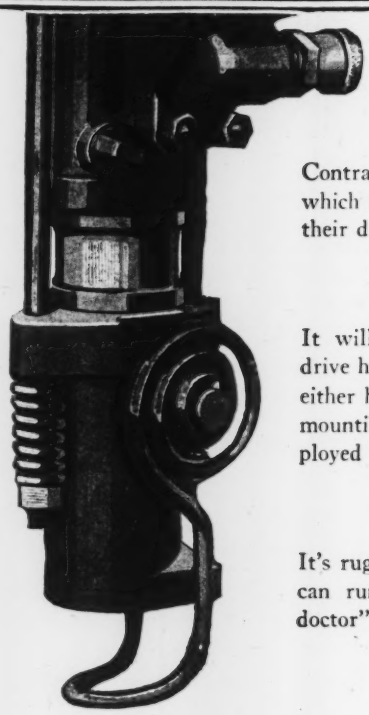
B BERGER

"JACKHAMER"

TRADE MARK REGISTERED AT OFFICE.



THE NAME OF A SUPERIOR ROCK DRILL SERVICE



An unmounted Jackhamer in the 6 x 8-ft. tunnel of the Springfield Tunnel and Development Co., Sonora, Cal., has been drilling a round of 8 holes 5 and 6 ft. deep in 80 minutes.

In 30 days recently it drove nearly 400 feet of tunnel. One driller and two muckers are used on each of 3 eight-hour shifts.

The rock is broken and rather soft, and the drill is used with the water tube removed to pass a strong blast of air through the steel.

Contractors find in the Jackhamer a drill which is adaptable to a large percentage of their drilling work.

It will sink shafts, ditch, drill benches, drive headings and small tunnels—in short, either hand held or in the handy feed shell mounting it can be advantageously employed wherever there's rock to be drilled.

It's rugged, efficient and reliable. Anyone can run it and it doesn't need a "drill doctor" to keep it going.

Bulletin 4321 *describes the Jackhamer and the mounting in which it is often used. Ask for a copy.*

INGERSOLL-RAND COMPANY

11 Broadway
New York

Offices the World Over

165 Q. Victoria St.
London

156-JD

Cooperative Service to the Export Buyer

THE ALLIED CONSTRUCTION MACHINERY CORPORATION was formed by the American International Corporation and a group of non-competing American Manufacturers of construction machinery.

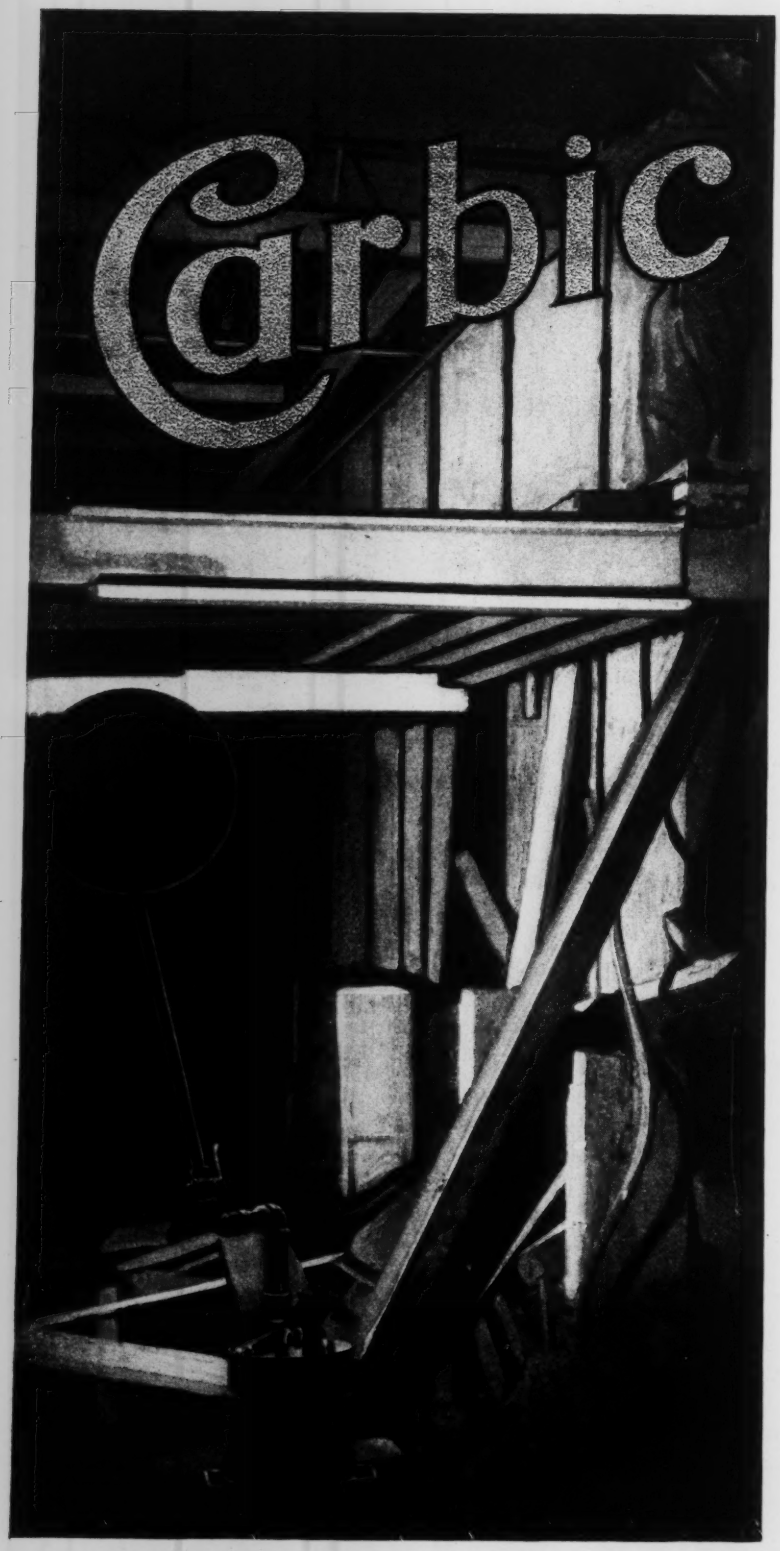
The buyer for export can secure from this single organization a complete line of contractors' plant and equipment — backed by undivided responsibility for shipments and guarantees.

The following manufacturers have joined this cooperative plan of serving the buyer for all export to all countries outside of the United States and Canada:

The Lakewood Engineering Company, Cleveland, Ohio.
The Thew Automatic Shovel Company, Lorain, Ohio.
The Parsons Company, Newton, Iowa.
The Hydraulic Pressed Steel Company, Cleveland, Ohio.
(Concrete Form Department)
Clyde Iron Works, Duluth, Minnesota.
C. H. & E. Manufacturing Company, Inc., Milwaukee, Wisconsin
Sterling Wheelbarrow Co., West. Allis., Wisconsin.
Barber-Greene Co., Aurora, Illinois.

For France, Spain, Italy, Portugal, Belgium and their colonies: the West Indies and China:
Western Wheeled Scraper Company, Aurora, Illinois.
Austin Manufacturing Company, Chicago, Illinois.

ALLIED CONSTRUCTION MACHINERY CORPORATION
Under the management and direction of the AMERICAN INTERNATIONAL CORPORATION
120 Broadway New York, U.S.A.
ALLIED ALLIED



Get the Light that Actually Saves Money

Get the light that *delivers all the light you pay for*—in other words, the light that burns with maximum brilliancy all night long on a single charge, without soot, smoke or smell.

Get the light that avoids waste of lighting material—in other words, the light that uses compact, economical Carbic Cakes. No unused particle of Carbic Cake is wasted at the end of the run. Every such piece can easily be saved and used again.

Get the light that is most simple. There are only 3 substantial hollow parts to a Carbic Light, and they can't be put together wrong.

Get a Carbic. *Test it out on your own job. We can predict your decision.*

ALLIED

Carbic Manufacturing Company

Main Office and Factory

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New York

Chicago

BRANCH OFFICES:
BOSTON
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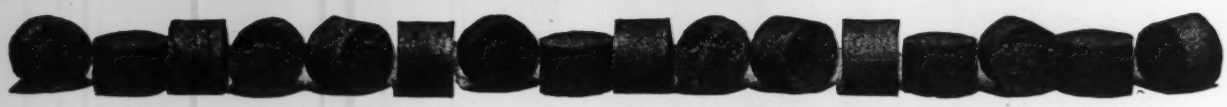
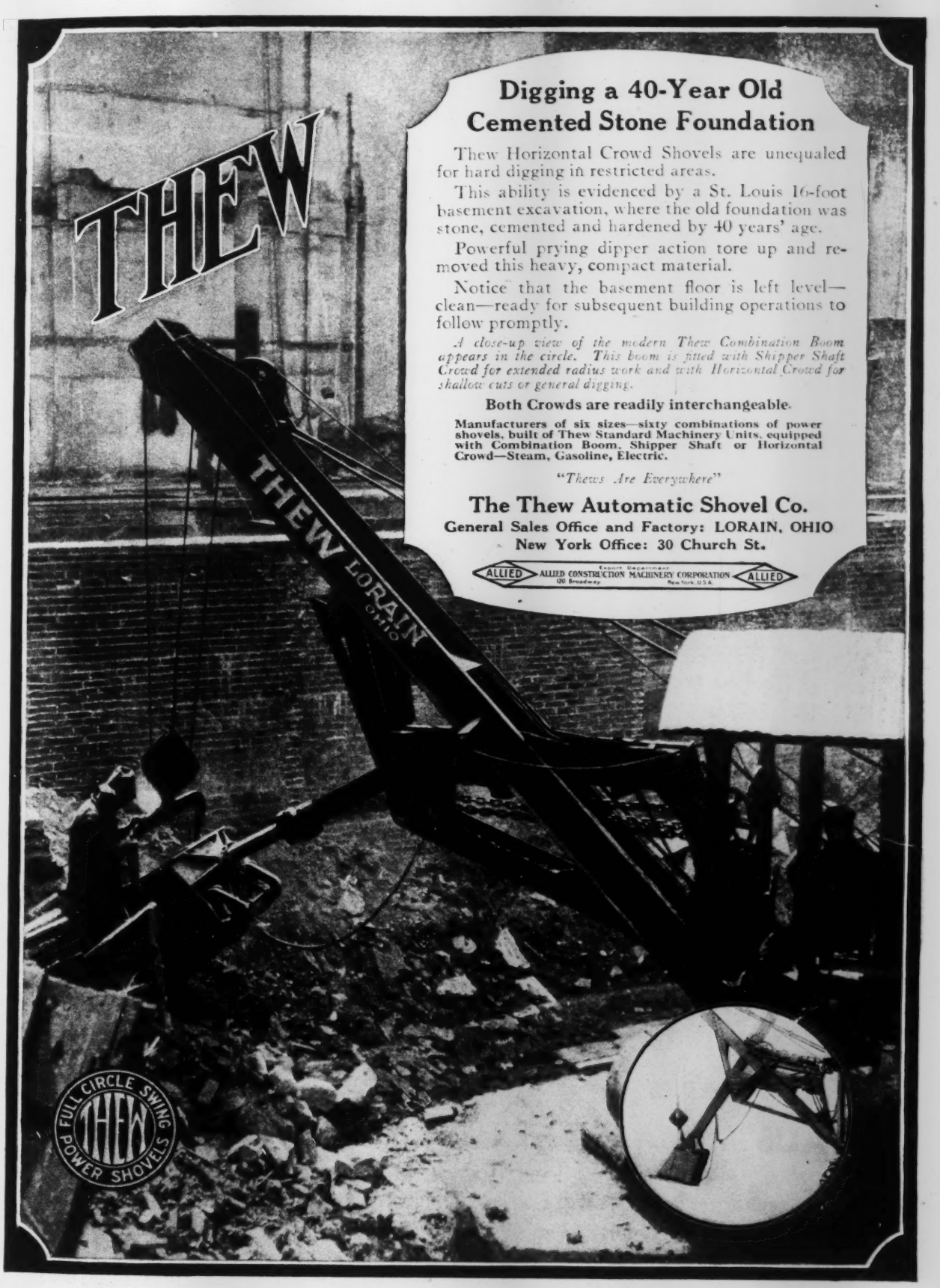
PHILADELPHIA
18 So. 7th St.
PITTSBURGH
101-109 Galveston Ave., N. S.
CLEVELAND
619 Guardian Bldg.

Warehouses and Representatives in Other Principal Cities.



CARBIC CAKES Save Money, Time and Patience



Digging a 40-Year Old Cemented Stone Foundation

Thew Horizontal Crowd Shovels are unequaled for hard digging in restricted areas.

This ability is evidenced by a St. Louis 16-foot basement excavation, where the old foundation was stone, cemented and hardened by 40 years' age.

Powerful prying dipper action tore up and removed this heavy, compact material.

Notice that the basement floor is left level—clean—ready for subsequent building operations to follow promptly.

A close-up view of the modern Thew Combination Boom appears in the circle. This boom is fitted with Shipper Shaft Crowd for extended radius work and with Horizontal Crowd for shallow cuts or general digging.

Both Crowds are readily interchangeable.

Manufacturers of six sizes—sixty combinations of power shovels, built of Thew Standard Machinery Units, equipped with Combination Boom, Shipper Shaft or Horizontal Crowd—Steam, Gasoline, Electric.

"Thews Are Everywhere"

The Thew Automatic Shovel Co.

General Sales Office and Factory: LORAIN, OHIO

New York Office: 30 Church St.

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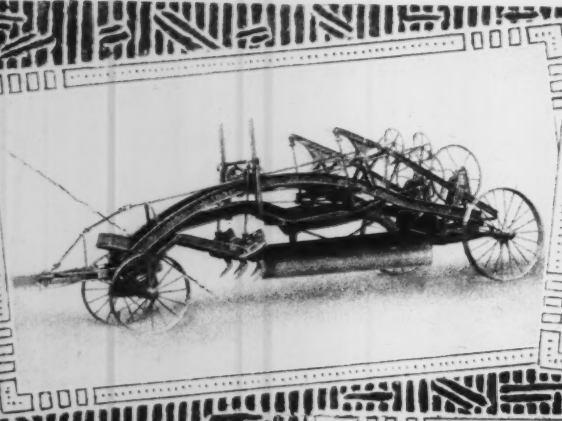

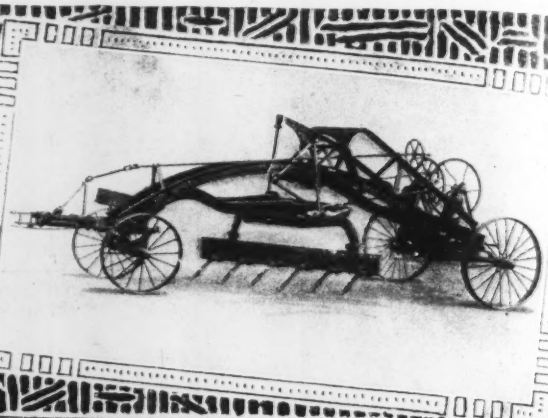

Austin

Make Old Roads New For One-Half Usual Cost

The Austin Rip-Snorter is the only machine that will rip up and regrade ready for rolling—all in one operation—partially worn, rutted macadam or gravel roads.

It will make old roads as good as new—for 50% less than customary expense. It is equally effective for preparing old road beds to receive brick or other paving.

This Rip-Snorter is a powerful scarifier and grader combined. Scarifier teeth and grader blade are adjusted independently, giving the operator perfect control of the working of each.

The Austin Road-Ripper is a scarifier attachment for the Austin Mammoth Tractor Grader. It increases greatly the working scope of the regular tractor grader for road making and maintenance.

Write for descriptive and illustrative Bulletins.

The Complete Austin Line

Gyratory Rock Crushers
Motor Tandem Rollers
Motor Macadam Rollers
Portable Stone Bins
Stone Elevators
Stone Screens
Elevating Graders
Blade Graders
Road Rollers
Road Scarifiers
Combined Scarifier-Graders
Street Sprinklers
Street Sweepers
Combined Sprinkler-Sweepers
Dump Wagons
Stone Spreaders
Horse-Drawn Rollers

AUSTIN MANUFACTURING COMPANY, Chicago

New York **San Francisco**

ALLIED — Sales for FRANCE, SPAIN, ITALY, PORTUGAL, BELGIUM and their Colonies, THE WEST INDIES and CHINA handled by ALLIED CONSTRUCTION MACHINERY CORPORATION, 120 Broadway, New York, U.S.A. — ALLIED

A Good New Year's Resolution to Make—

Plan on visiting Cleveland immediately to inspect the Hydraulic demonstration of Steel Form Concrete Construction—see the 20 houses being erected—see how *one set* of forms may be used for all the ten different types of houses—watch the new and quick conveyor method of pouring the concrete—see the finished houses.

Many others nave come. You are cordially invited—it will pay you.

The Hydraulic Pressed Steel Company
Cleveland, Ohio
Manufacturers of Wall, Column, Sewer, Tunnel and House Forms.
NEW YORK OFFICE: Singer Building, 149 Broadway
CHICAGO OFFICE: Fisher Building, 342 Dearborn Street
WASHINGTON OFFICE: Lafayette Hotel

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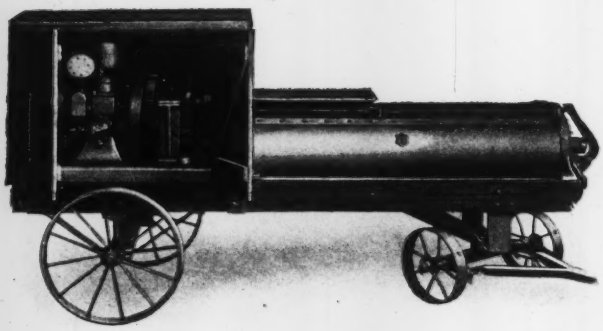
"Hydraulic" Community Homes



LAKEWOOD
CONSTRUCTION PLANT

Lakewood Mortar Mixers

mix stiff lime and sand thoroughly and uniformly. Keep 30 to 40 brick-layers busy. Increase the day's work by 10 to 20 per cent. more brick laid and save men. Electric or gasoline power.

Built to Last—and for maximum profit to the user.

Send for Bulletin 24.

Link up with Lakewood

LAKEWOOD BUILT TO LAST

Lakewood Engineering Co., Cleveland

FACTORIES

LAKEWOOD GALION CHICAGO HEIGHTS WEST PARK MILWAUKEE ELYRIA

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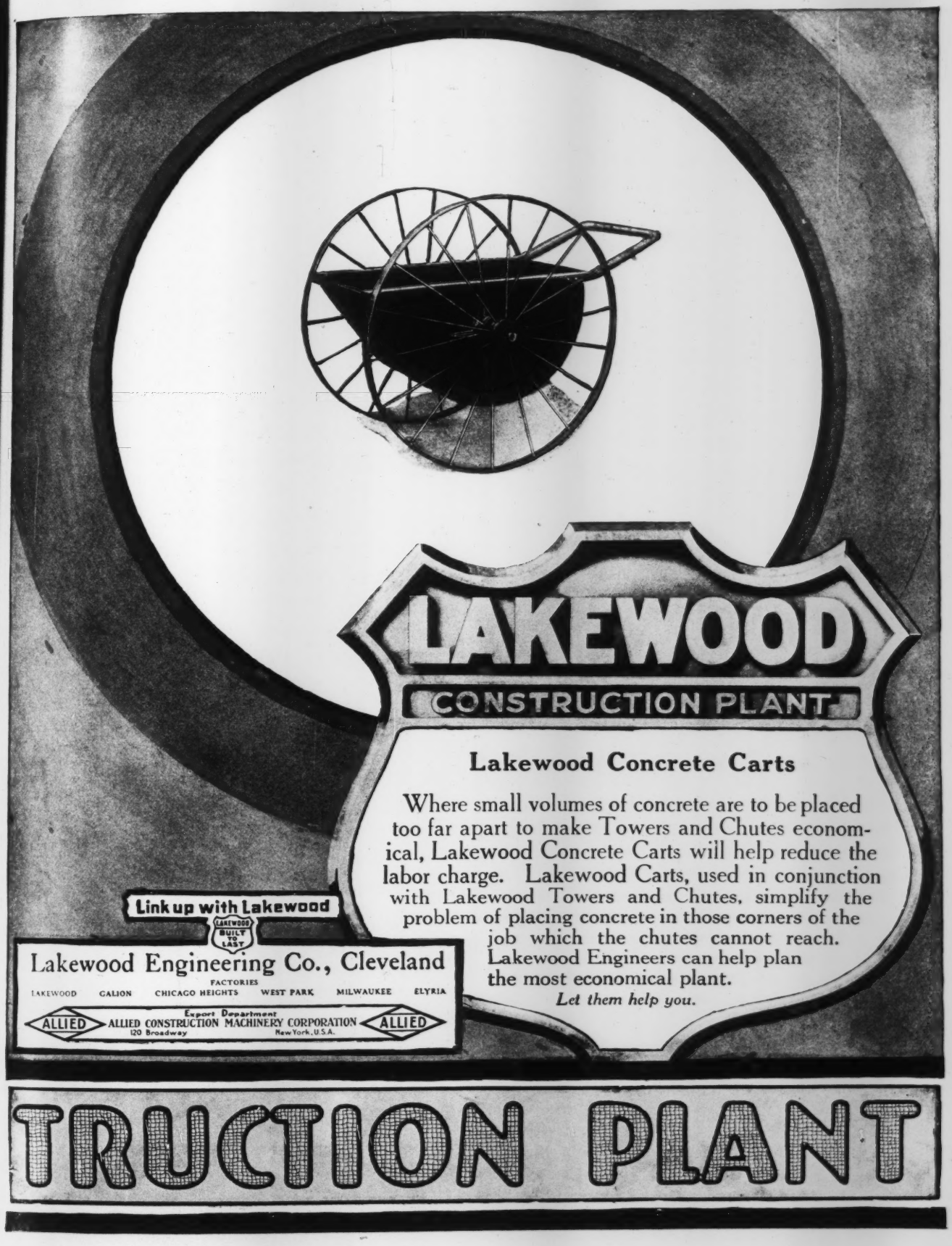
LAKEWOOD CONS


LAKEWOOD
CONSTRUCTION PLANT
Lakewood Concrete Carts
Where small volumes of concrete are to be placed too far apart to make Towers and Chutes economical, Lakewood Concrete Carts will help reduce the labor charge. Lakewood Carts, used in conjunction with Lakewood Towers and Chutes, simplify the problem of placing concrete in those corners of the job which the chutes cannot reach. Lakewood Engineers can help plan the most economical plant.
Let them help you.
Link up with Lakewood
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Lakewood Engineering Co., Cleveland
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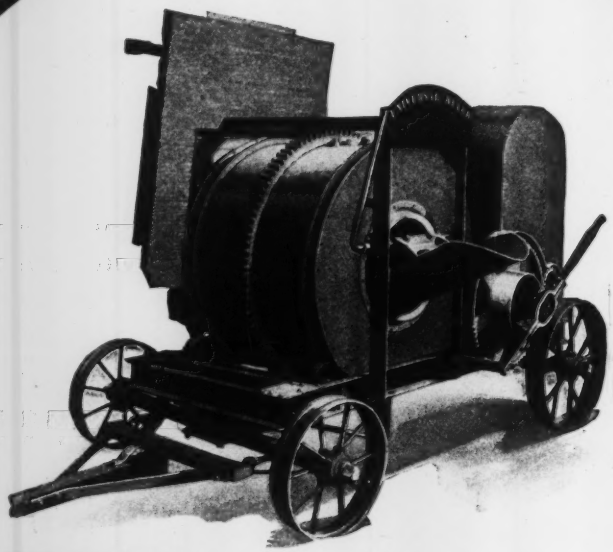
TRUCTION PLANT



LAKEWOOD

CONSTRUCTION PLANT

Lakewood Universal Mixer

Portability and fast mixing of one-bag batches are features of the Lakewood Universal Mixer. Capacity 7 cu. ft. of mixed concrete. Mixes 80 to 100 yds. a day.

A low-price machine that will serve you well —It's "Built to Last."

Immediate Delivery.

Link up with Lakewood

LAKEWOOD BUILT TO LAST

Lakewood Engineering Co., Cleveland

FACTORIES

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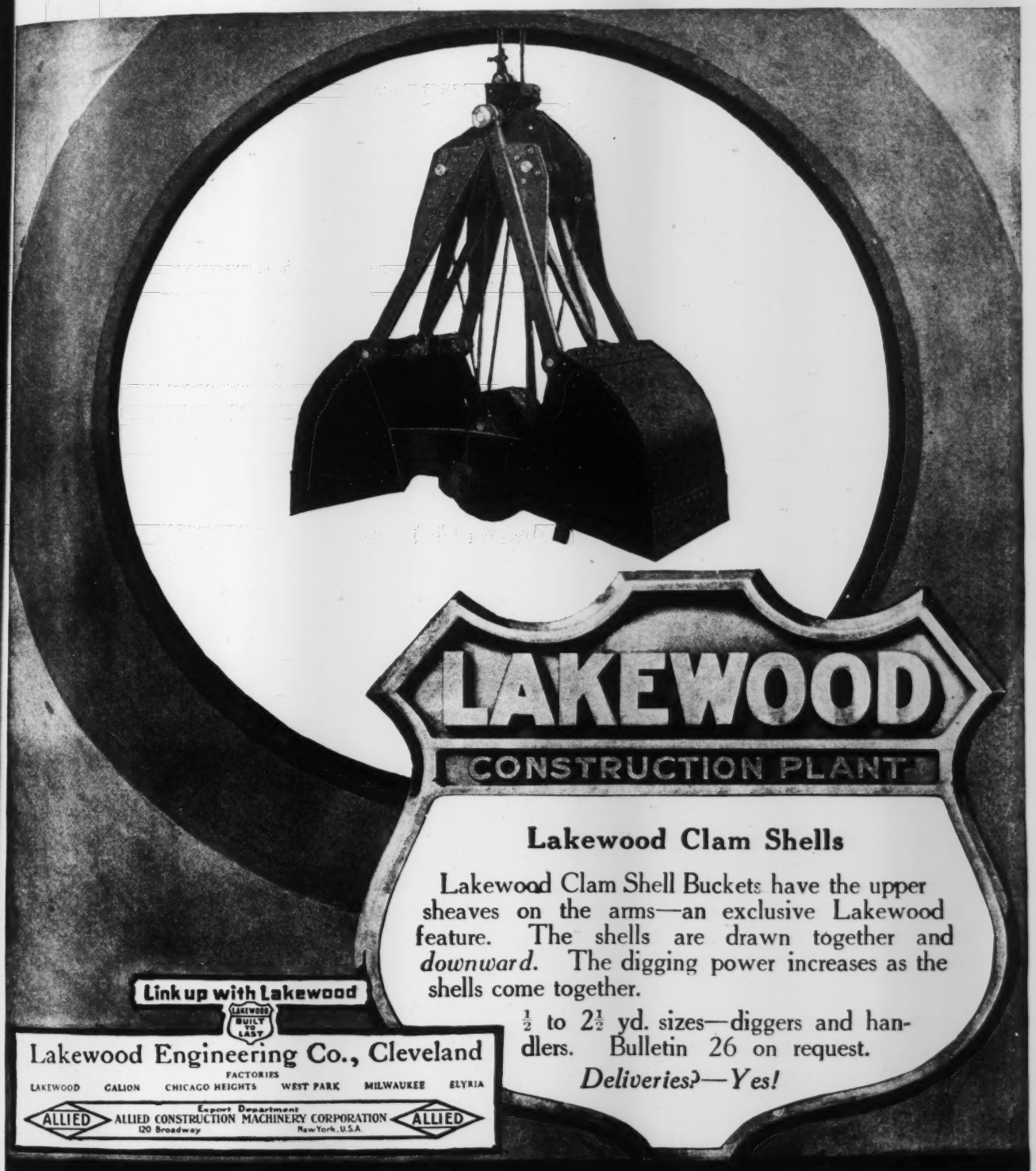
120 Broadway New York, U.S.A.

LAKEWOOD CONS



LAKEWOOD
CONSTRUCTION PLANT

Lakewood Clam Shells

Lakewood Clam Shell Buckets have the upper sheaves on the arms—an exclusive Lakewood feature. The shells are drawn together and *downward*. The digging power increases as the shells come together.

½ to 2½ yd. sizes—diggers and handlers. Bulletin 26 on request.

Deliveries?—Yes!

Link up with Lakewood

LAKEWOOD BUILT TO LAST

Lakewood Engineering Co., Cleveland

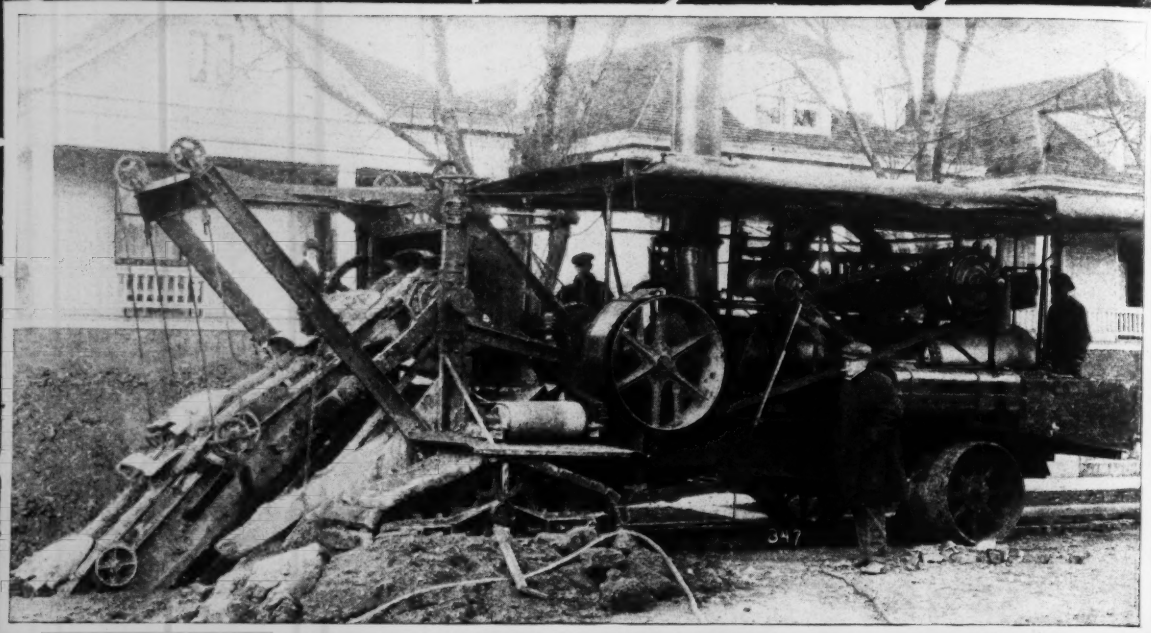
FACTORIES

LAKEWOOD GALION CHICAGO HEIGHTS WEST PARK MILWAUKEE ELYRIA

ALLIED — Export Department — ALLIED CONSTRUCTION MACHINERY CORPORATION — ALLIED

120 Broadway New York, U.S.A.

TRUCTION PLANT



PARSONS

"OVER HERE"—"OVER THERE"

The closing year finds Parsons Excavators in constantly increasing numbers wherever there is trenching to do.

'Over Here"—"Over There," they are mighty contributors to ultimate victory in the Allied fight for universal freedom.

Installing drainage systems—reclaiming swamps and increasing the productiveness of cultivated lands, they are directly instrumental in helping to provide adequate food for ourselves and our Allies.

Digging sewer and water trenches, they insure health and comfort to soldiers, war workers and civilians.

Parsons Trench Excavators' popularity is founded on their dependable, economical, speedy operation and their ability to dig ALL WIDTHS—ALL DEPTHS—IN ANY SOIL.

Manufacturers of Trench Excavators and Backfillers

PARSONS

THE PARSONS COMPANY, Newton, Iowa

New York Office: 18 West 34th Street

ALLIED — Export Department — ALLIED CONSTRUCTION MACHINERY CORPORATION — 120 Broadway, New York, U.S.A. — ALLIED

A Machine for Every Job

CLYDE CLYDE

The Plant Behind the Machinery

The photograph above illustrates the complete Clyde Plant, covering more than seven acres of floor space.

This compact, substantially built plant is equipped with the most modern appliances Clyde Engineers have been able to purchase or invent in order to produce Hoisting Machinery that will measure up to the high Clyde standard. While Clyde specializes in the Standardization of various types of Hoisting Machinery, and is equipped to supply out of these Standards the necessary Machinery to handle almost any given conditions, both the plant and its efficient engineering organization are at all times ready to serve anyone with a special problem to solve.

When you put your special problems up to Clyde, you are assured of prompt, intelligent, effective cooperation.

CLYDE-GRADE LINE

Manufacturers of Steam, Electric, Gasoline and Belt Hoists; Derricks; Excavators; Blocks and Sheaves, etc. ***(The Big, Red Catalog, or individual Bulletins sent cheerfully upon request.)***

CLYDE IRON WORKS, Duluth, Minn., U.S.A.

Branch Offices and Warehouses:

NEW ORLEANS, 414-416 Carondelet Street. CHICAGO, 343 South Dearborn Street. SEATTLE, 522 First Ave., South. NEW YORK, 50 Church Street. SAVANNAH, 501 Germania Bank Bldg. PORTLAND, ORE., 18th and Upshur Streets.

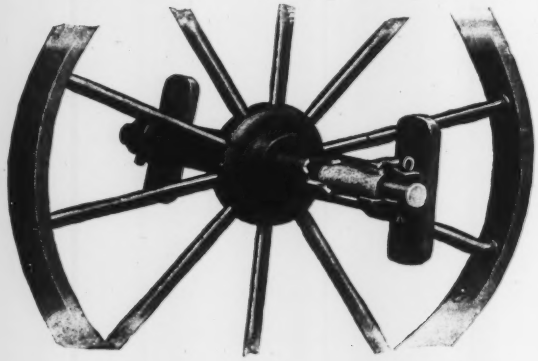
ALLIED — Export Department — ALLIED CONSTRUCTION MACHINERY CORPORATION — 120 Broadway, New York, U.S.A. — ALLIED

HOISTING CLYDE MACHINERY

Don't Ask for Wheelbarrows—Ask for Sterling with 10-Spoked Wheels

Though they go by the same name in the index of a catalogue, there is as much difference in wheelbarrows as there is in men and horses. In each case there are scrubs and thoroughbreds.

The fellow who thinks that a wheelbarrow is an unimportant tool which should be purchased by price only, is going to pay the bill many times through maintenance cost, excessive handling cost, loss of time and efficiency. If you have trouble with your wheelbarrows, you have trouble with your men—ASK YOUR FOREMAN.



Sterling Wheelbarrows are BEST because of their wheel—ASK THE MAN WHO USES THEM. He will tell you that Sterling wheelbarrows wheel easier because the wheels are equipped with self-lubricating bearings. That the hub cannot break because it is made of steel instead of cast iron. He will tell you that he has no trouble with breakage, as Sterling wheelbarrows are built to stand the gaff.

The Sterling Wheel is now better than ever before, because 2 spokes have been added to its construction, giving a total of 10 spokes, instead of the usual 8 spokes. By virtue of this new wheel, the Sterling again leads the procession with advanced ideas and improvements in wheelbarrow construction, and merits one more reason why you should say "Sterling" when you need wheelbarrows.

Write For Our Catalog

STERLING WHEELBARROW COMPANY

STERLING ON A WHEELBARROW MEANS MORE THAN STERLING ON SILVER

Milwaukee — Wisconsin

ALLIED — Allied Construction Machinery Corporation — ALLIED

LIBERTY
URANIUM HI-SPEED STEEL

Carries the O. K. of the Men Who Know

LIBERTY Uranium Hi-Speed Steel is winning its way rapidly into the large machine shops throughout the country into the esteem and confidence of the men responsible for production.

WHY? Because it takes and holds a cutting edge which permits of steady, high-quality work on the most difficult materials for the longest periods without grinding—because it has maximum staying qualities.

The piece workman is looking for Liberty Uranium Hi-Speed Steel. It increases wages by enlarging his daily output. It frees him from the delays caused by less reliable steel in his cutting tools.

The blacksmith and tool dresser like Liberty Uranium Hi-Speed Steel because it is easy to work, because it allows them to obtain the best tool making results in the shortest time.

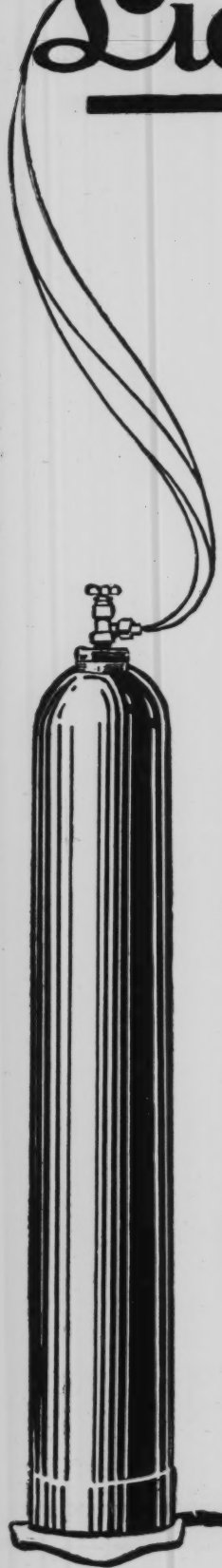
Plant managers O. K. it because greater production is the national need of the day—and Liberty Uranium Hi-Speed Steel PRODUCES.

Write Us for the Proofs

LIBERTY STEEL PRODUCTS CO., Inc.

New York, Woolworth Bldg.; Philadelphia, Widener Bldg.; Pittsburgh, First Nat'l Bank Bldg.; San Francisco, Newhall Bldg.; Seattle, L. C. Smith Bldg.; Chicago, McCormick Bldg.; Boston, 201 Devonshire St.

"Liquid Chlorine"



is as much superior to Hypochlorite (Chloride of Lime) in the treatment of Sewage as it is in the sterilization of Water.

100% Pure

—of continued full strength—with no waste by-products—shipped in convenient and easily handled steel cylinders. E. B. G. Liquid Chlorine warrants serious consideration whenever the treatment of sewage is discussed.

Send for interesting booklet

ELECTRO BLEACHING GAS COMPANY

Pioneers and Leading Manufacturers of Liquid Chlorine

18 East 41st Street, New York

Chicago Office: 11 So. La Salle Street
Canadian Representative: General Supply Co. of Canada, Ltd.,
Ottawa, Toronto, Montreal, Winnipeg, Vancouver.

Liquid EBG Chlorine

The Chlorination of SEWAGE

WHERE sewage is discharged into waterways used for public water supplies it is essential that the sewage be STERILIZED to prevent pathogenic bacteria polluting the water and causing disease.

LIQUID CHLORINE

is just as applicable in the treatment of sewage as it is with water supplies.

"W & T" APPARATUS

is widely used in the application of Liquid Chlorine to Sewage.

Special types of Equipment are available to automatically proportion the Chlorine to the flow of sewage.

Let us send detailed information.

Wallace & Tiernan Co., Inc., New York

Bethlehem Steel Company

South Bethlehem, Pennsylvania

PIG IRON: Basic, Bessemer, Foundry, Low Phosphorus, Mayari, Ferro-Manganese, Spiegeleisen.

CASTINGS: Steel and Iron, Brass, Bronze and Manganese.

FORGINGS: Drop, Hammered, Hydraulically Pressed, Solid and Hollow, Rough, and Finished Machined; Cement Mill and Ore Crusher Balls.

RAILS: Standard, Girder, Guard, High Tee, Industrial, Splice Bars, Tie Plates, Bolts, Frogs, Switches, Signals.

SWITCH STANDS: To Meet Every Track Condition; High, Intermediate and Low Stands, Adjustable and Non-Adjustable.

MANARD ANVIL-FACE FROGS: Equipped with "Mayari" Never-Turn Bolts. All Bolts Receiving Side Thrust of Wheels are HEAT TREATED.

STRUCTURAL STEEL SHAPES: Bethlehem Beams, Girders and Columns; Standard Beams, Channels and Angles.

TOOL STEELS: Carbon, High Speed, Drill, Finishing and Special.

STANDARD, ALLOY AND SPECIAL STEELS: Chrome Nickel, Chrome Vanadium, Mayari, Case Hardened, Special; Treated, Tempered and Cold Drawn.

TIN PLATES: Black, and Tinned Plates; Stamping and Enameling Stock.

BAR IRON: Refined Bar Iron, Double Refined, Chain, Staybolt, Special Staybolt, and Engine Bolt Iron.

BOLTS: All Kinds, Plain and Galvanized, Machine, Carriage, Lag, Plow and Patch; HEAT TREATED, Simple Alloy Mayari Steel Frog, Track, and Fitting-up Bolts.

NUTS: Hot and Cold Pressed, Cold Punched, and Forged, All Sizes, Shapes and Standards, Blank or Tapped, Chamfered, Trimmed and Reamed, Case Hardened, Castle, Semi-Finished and Finished.

RIVETS: Boiler, Bridge, Structural, Ship, Tank and Tap.

SPIKES: Steel and Iron, Standard Railroad, Screw Railroad Track, Universal Screw, Boat, Dock and Wharf, Pressed and Rolled.

Engineers and Builders of Special Machinery

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Furnace and Foundry Coke and Coke By-Products

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Gun Carriages, Limbers and Caissons, Gun Forgings, Torpedo Air Flasks, Armor Plate, Projectiles, Fuses, Cartridge Cases, Complete Rounds of Ammunition

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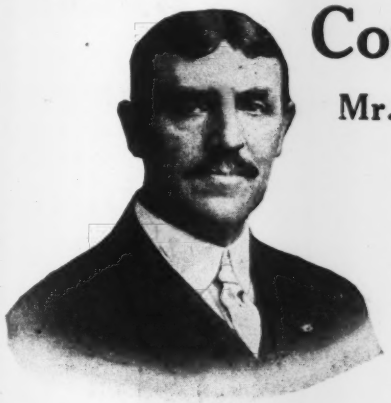


Charles E. Golden
President and General Manager

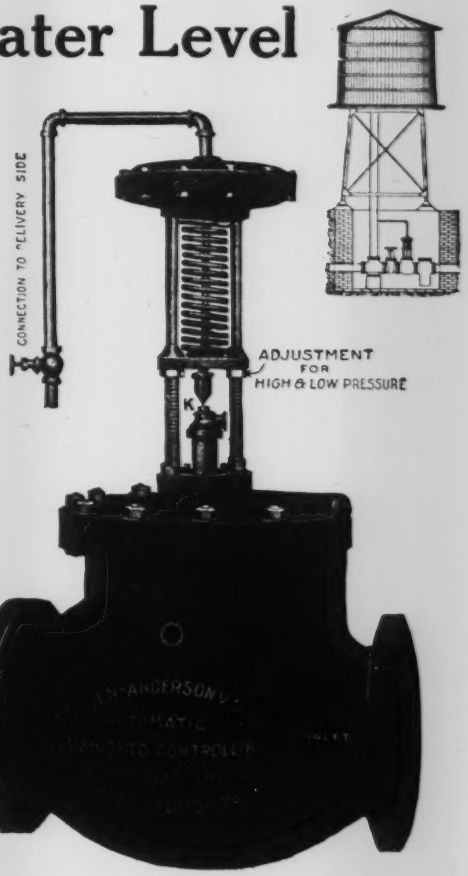
Constant Water Level

Mr. Golden says:—

A uniform stage of water can be carried in your reservoirs, stand pipes and tanks without worry or trouble.

Such a maintained head of water will eliminate all water loss down the overflow and will insure the most efficient flow through your mains.

There will be no variation in water level after your supply lines are fitted with



GOLDEN-ANDERSON

Patent Automatic Cushioned Controlling Altitude Valves

1—Give positive control of inflow to reservoirs to hold the required water level absolutely constant.

2—Self-contained. Operated without floats or fixtures inside or outside of tanks.

3—Perfectly cushioned by water and air—making water hammer, surges or shock impossible.

4—Can be closed in three ways: —by increasing water pressure —by electricity from distant points—and by hand.

5—Can be connected to close automatically to shut off water loss if pipe breaks.

6—Will work "both ways" on a single pipe line to return storage water for distribution.

7—Sizes to 24 inches.

Golden-Anderson Life and Property Insurance Valves

1—The sure protection against loss of life and property destruction in case of the sudden release of steam through a burst boiler tube or a break in any steam main.

2—Prevents complete shut down in case of accident to any boiler or steam line.

3—Automatically equalizes pressure between all boilers and prevent inflow of steam into a cold boiler.

4—Double cushioned by double Corliss dash pot.

5—The only valves that can be tested in service.

6—Can be closed by electricity or steam from distant points.

7—Angle, globe or elbow pattern.

Golden-Anderson

Patent Cushioned Water Service Valves

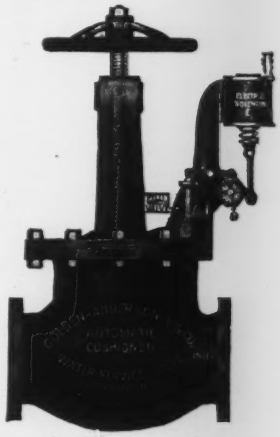
1—Insure full water pressure in case of fire.

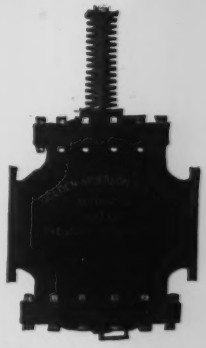
2—Perfectly controlled by electricity from distant points.

3—Operated by either d. c. or a. c. solenoid.

4—Perfectly cushioned by both water and air.

5—Sizes to 24 inches.





Golden-Anderson

Patent Automatic-Cushioned Water Pressure Reducing Valves

1—Maintain a constant reduced water pressure at all times.

2—Perfect cushioning by both water and air.

3—Easily adjusted from the outside and stay adjusted.

4—Fitted with cups and seat rings to take all wear and prevent metal-to-metal seats. Valves virtually indestructible.

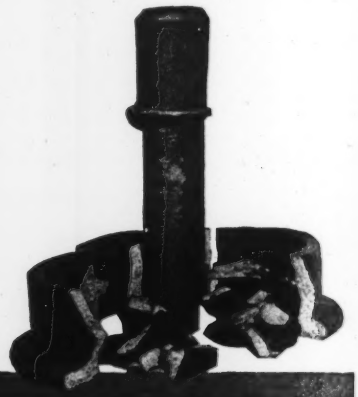
5—Positive in closing. No water hammer, surges or burst mains.

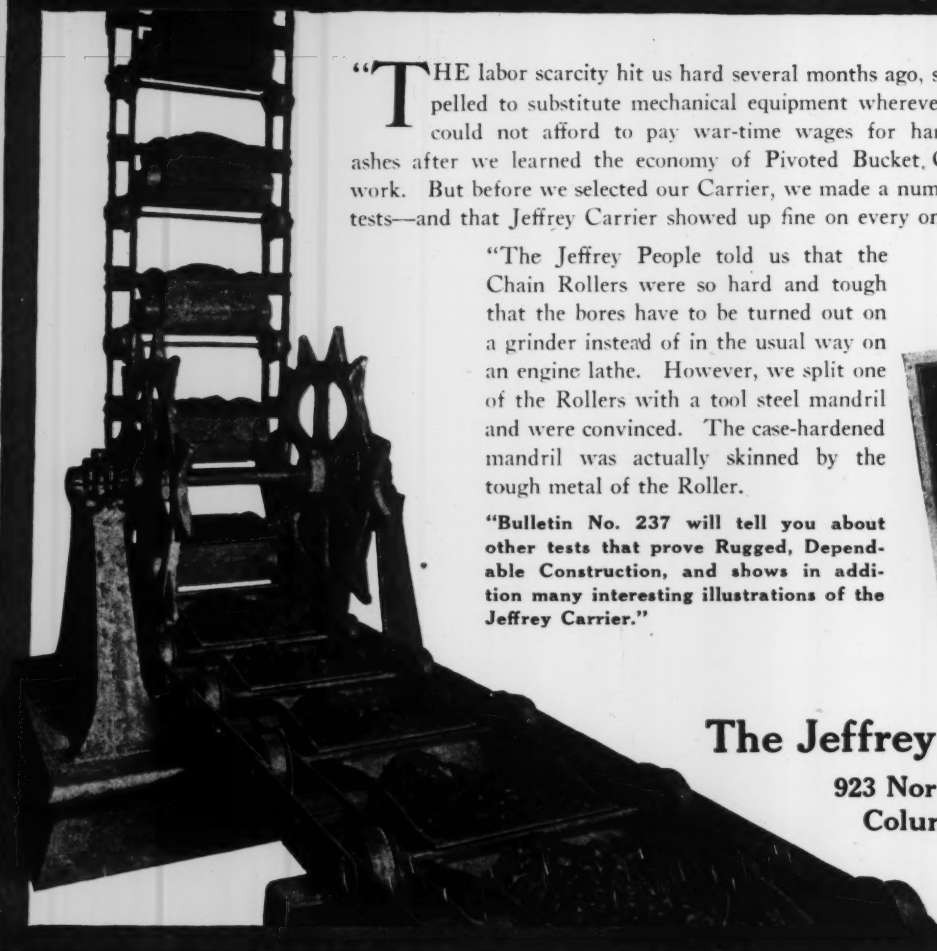
6—May be fitted with simple electric attachment for instant full opening from distant points. Sizes to 24 in.

"Hosts of References" "Every Valve With an Absolute Guarantee"

Golden-Anderson Valve Specialty Co., 1202 Fulton Bldg., Pittsburgh, Pa.

"Yes, We Skinned This Tool Steel Mandril in Breaking the JEFFREY Chain Roller"





"THE labor scarcity hit us hard several months ago, so we were compelled to substitute mechanical equipment wherever possible. We could not afford to pay war-time wages for handling coal and ashes after we learned the economy of Pivoted Bucket Carriers on this work. But before we selected our Carrier, we made a number of thorough tests—and that Jeffrey Carrier showed up fine on every one.

"The Jeffrey People told us that the Chain Rollers were so hard and tough that the bores have to be turned out on a grinder instead of in the usual way on an engine lathe. However, we split one of the Rollers with a tool steel mandril and were convinced. The case-hardened mandril was actually skinned by the tough metal of the Roller.

"Bulletin No. 237 will tell you about other tests that prove Rugged, Dependable Construction, and shows in addition many interesting illustrations of the Jeffrey Carrier."

The Jeffrey Mfg.Co.
923 North Fourth St.
Columbus, Ohio

WHY not give us an opportunity to quote on your requirements for high grade screw machine products $\frac{1}{8}$-in. to $3\frac{3}{4}$-in. capacity, light and heavy machine work, stampings and electro-galvanizing? Our facilities for QUANTITY PRODUCTION are at your disposal.

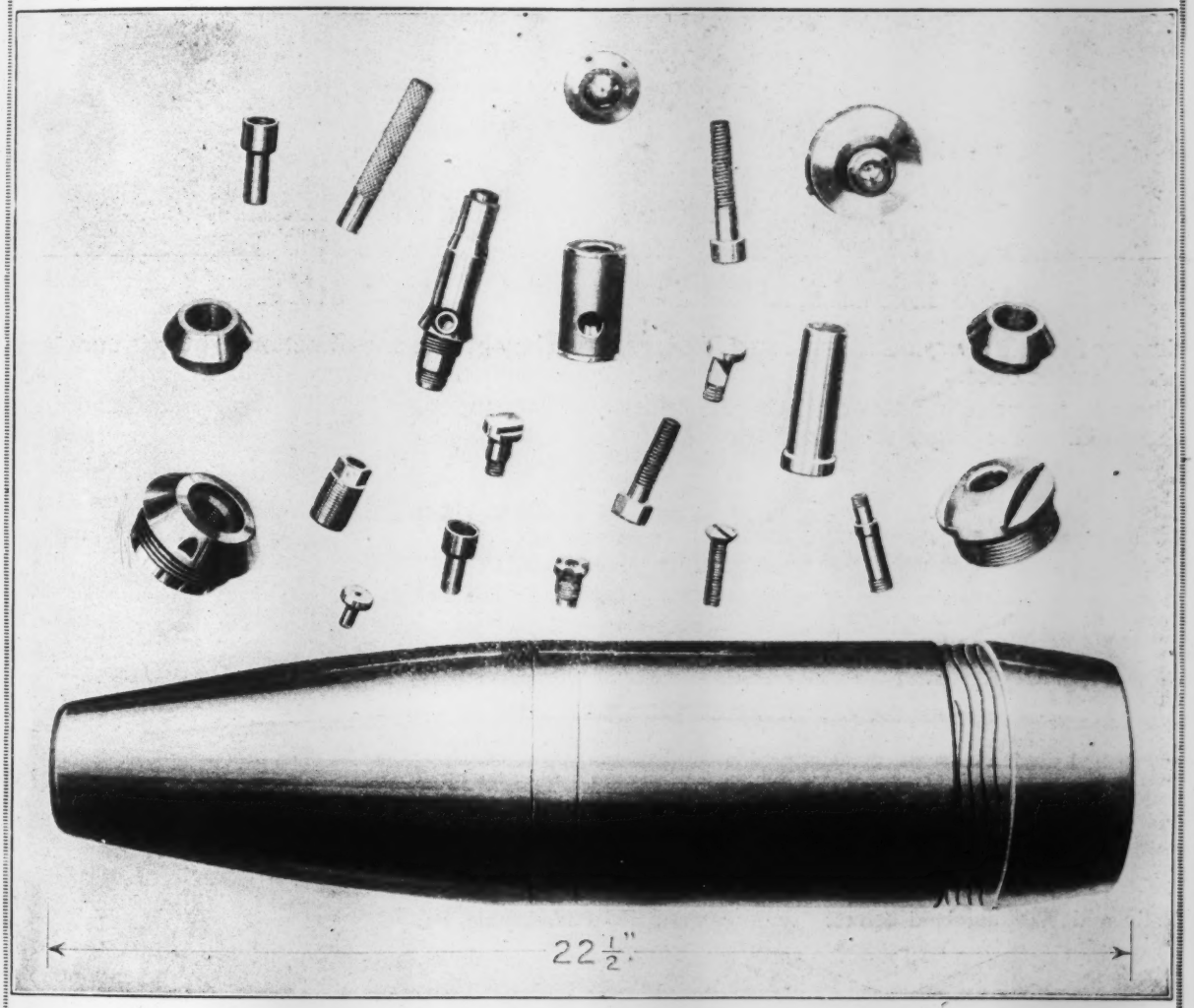


ILLUSTRATION OF SOME OF THE WORK WE HAVE BEEN DOING RECENTLY

For Accuracy and Prompt Delivery, Write

INTERNATIONAL ARMS & FUZE CO., INC.

Factories: BLOOMFIELD, NEW JERSEY MONTREAL, CANADA

Better and Cheaper than Sawtooth

Sawtooth roofs are good for narrow buildings, bad for wide ones.

They do not ventilate the center: the wider the building the larger the "dead" area.

They give a one-direction light, with unpleasant contrasts for anyone facing north.

The modern lighting and ventilating roof is the

Pond Truss

PATENTED

THE ROOF THAT VENTILATES

It utilizes the natural air movements in a wide building. It gives an all-directions light, without shadows or glare. It does both at less than sawtooth cost.

A notable Pond Truss building is here shown. Between the outlet lines of Pond Continuous Sash are other lines admitting both light and air while excluding rain. All the roof sash are operated by electric motors in lines hundreds of feet long.

The Pond Truss represents the best possible use of top-hung weather-proof Pond Continuous Sash. It permits one-story factory buildings to be made of any desired width and length, without the drawbacks of ordinary roofs. It is patented, and its use is licensed where Lupton Products are used in the same building.

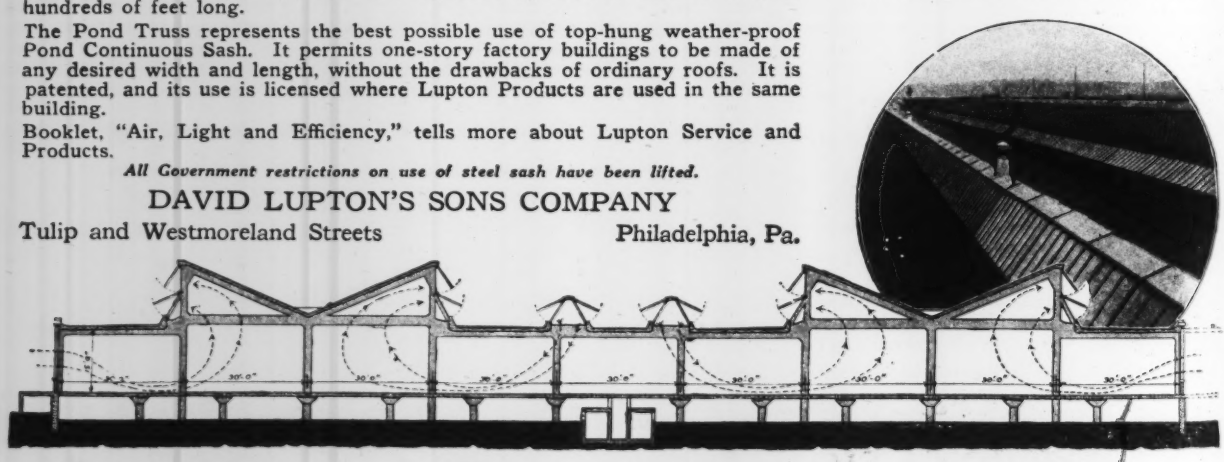
Booklet, "Air, Light and Efficiency," tells more about Lupton Service and Products.

All Government restrictions on use of steel sash have been lifted.

DAVID LUPTON'S SONS COMPANY

Tulip and Westmoreland Streets Philadelphia, Pa.

Illustrations show main manufacturing building of Dayton-Wright Airplane Co. Messrs. Schenck & Williams, Architects. Size, 270 x 1000 feet. Will eventually be 870 feet wide. Roof has two Pond Trusses, with Pond A-frames between. Pond Continuous Sash used in all roof openings.



Pond Continuous Sash for Pond Truss, sawtooths, monitors and side walls

Pond Operating Device for long lines of sash

Lupton Rolled Steel Skylight

Lupton

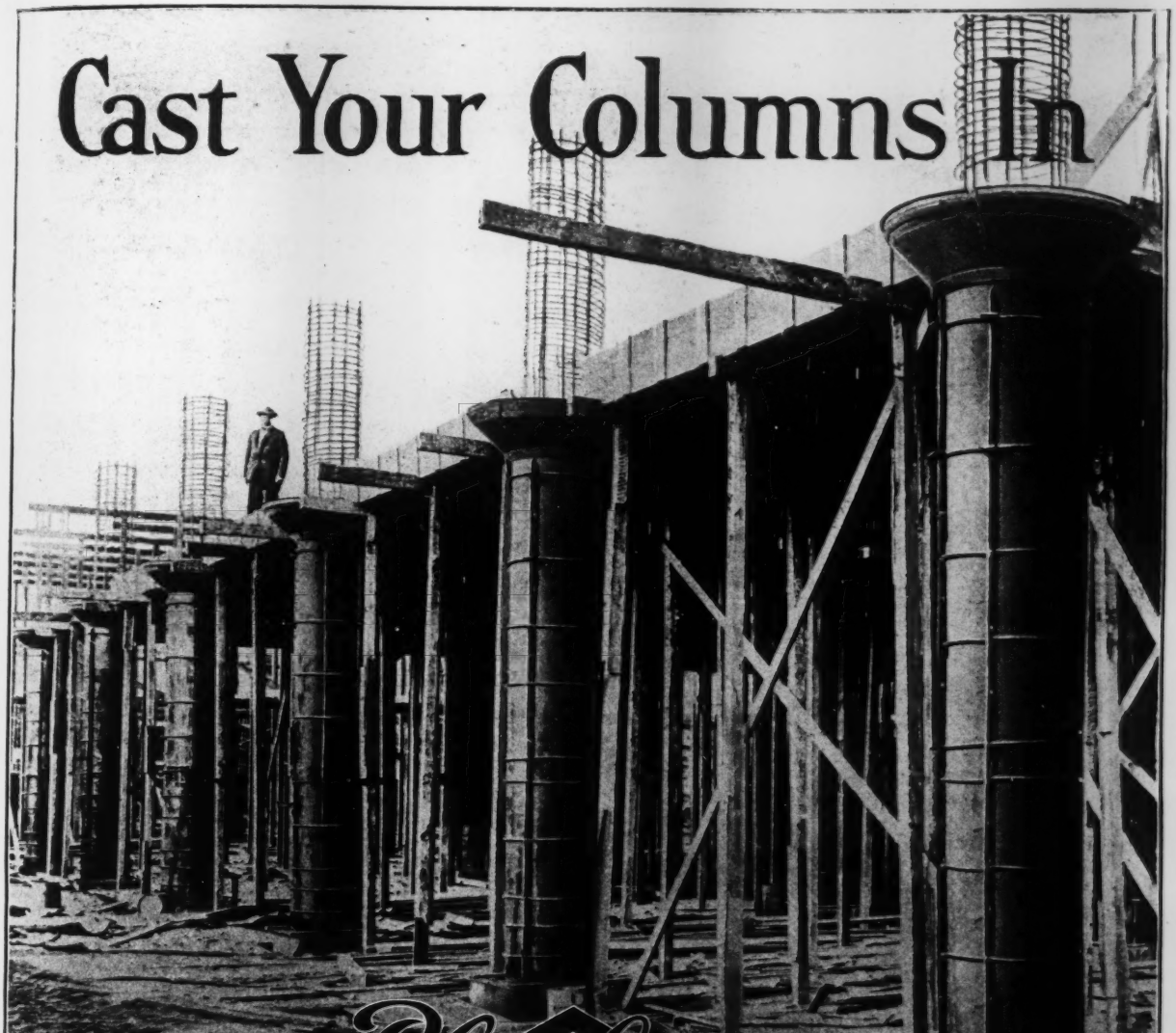
INVESTMENT VALUE

Lupton Steel Sash

Pivoted Factory Type
Counterbalanced Type
Counterweighted Type

Lupton Steel Partition and Doors

Cast Your Columns In



Blawforms

"BLAW" COLUMN MOLDS differ from the ordinary type, particularly in regard to rigidity, adjustability, strength, tightness, lightness, simplicity, interchangeability, adaptability and cost of erection.

There are many other advantages—all of which are outlined in "BLAW" Bulletin 67; write for a copy.

Submit your column schedule to the BLAWFORMS Engineers.

BLAW-KNOX COMPANY

601 Farmers Bank Bldg., Pittsburgh, Pa.

New York, 165 Broadway

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Foreign Sales Representatives:
Gaston, Williams & Wigmore Inc.
39 Broadway,
New York City

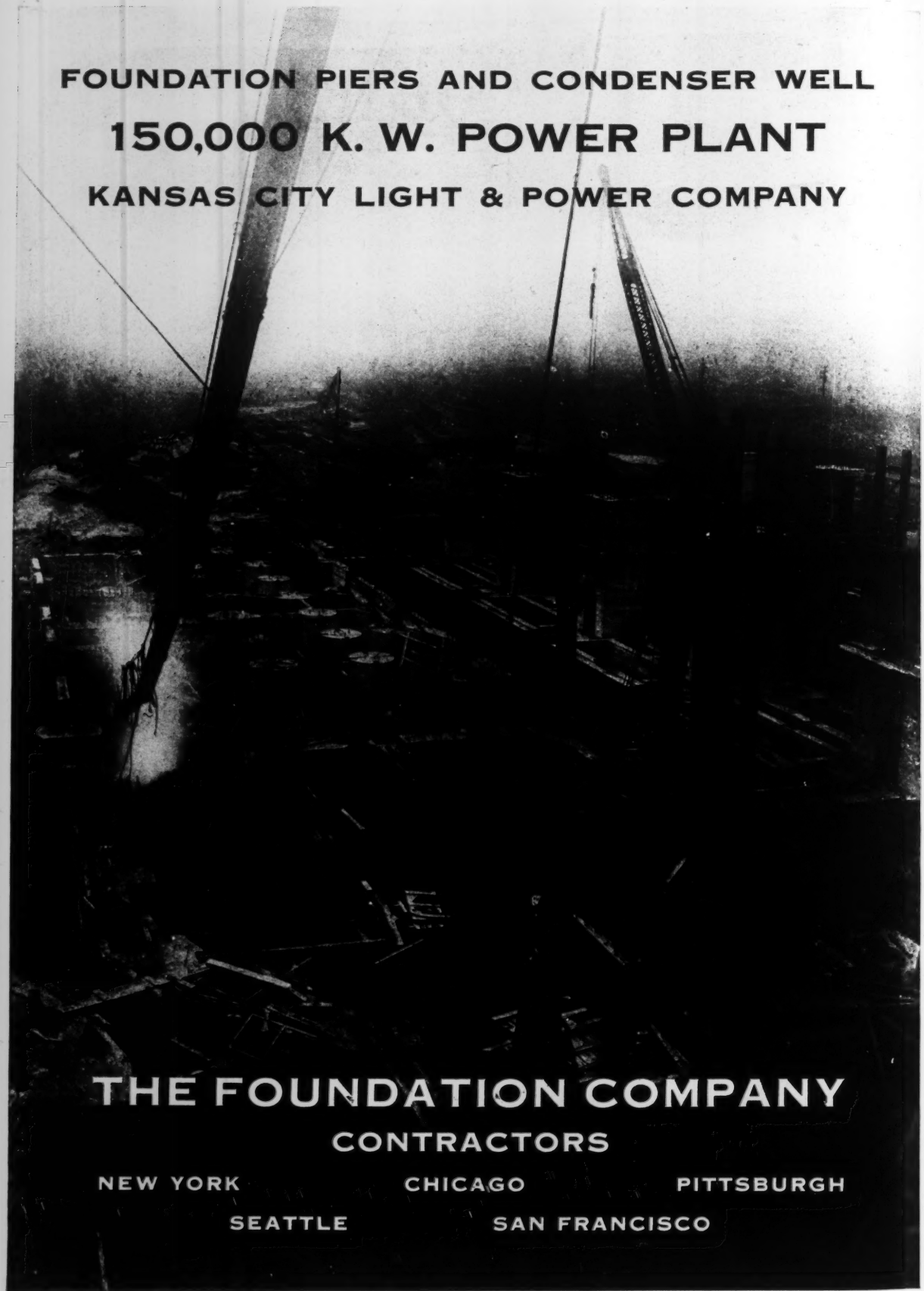
BUCKETS FOR ALL PURPOSES — Blaw

The Blaw-Ransomizer — Blaw-Knox Company

FOUNDATION PIERS AND CONDENSER WELL

150,000 K. W. POWER PLANT

KANSAS CITY LIGHT & POWER COMPANY



THE FOUNDATION COMPANY

CONTRACTORS

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For the Needs of Peace

THE ending of the great world war has opened the way for new construction that has long been urgently needed—Schools, Homes, Churches, Factory buildings, Public buildings,—Structures of all sorts. Sheet Metal will form an essential part of most of these buildings. Sheet Metal is used for cornices, roofs, sidings, eaves trough, balconies, flashings, ridges, gutters, ventilators and in many other ways.

It is vitally important that all the Sheet Metal used should be lasting, should resist corrosion.

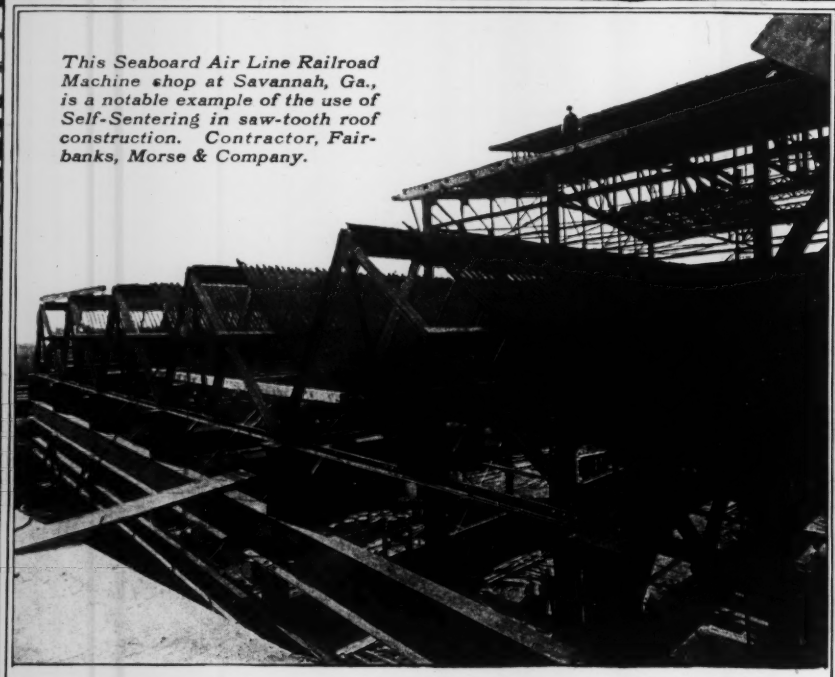
The important factor of cost is all in favor of Ferric Sheet Metal.

Among sheet metals made from iron ore base, time and the experience of hundreds of building owners have proven that TONCAN METAL is unsurpassed in its ability to resist corrosion—to give long satisfactory service.

If you are building for permanence, specify TONCAN METAL for all Sheet Metal work.

Our "Corrosion Book" gives a lot of interesting information about sheet metal. It's yours on request.

The Stark Rolling Mill Co., Canton, O.
Sole Makers



This Seaboard Air Line Railroad Machine shop at Savannah, Ga., is a notable example of the use of Self-Sentering in saw-tooth roof construction. Contractor, Fairbanks, Morse & Company.

Economical—Durable—and Fire-Safe

The illustration shows the use of GF Self-Sentering by the Seaboard Air Line R. R.—the saw-tooth roof of their great machine shop at Savannah. In all cases, this construction will withstand the hottest flames, and is amply staunch to bear a load in excess of standard requirements. Yet its use means less concrete, less weight, and lighter framework through the structure.

Self-Sentering

is a combined centering and reinforcing for concrete roof and floor construction. It consists of a parallel series of heavy, cold-drawn ribs connected by diamond mesh—a most efficient form of expanded metal.

Self-Sentering is economical because it does away with temporary wooden forms. It acts as a form

GF

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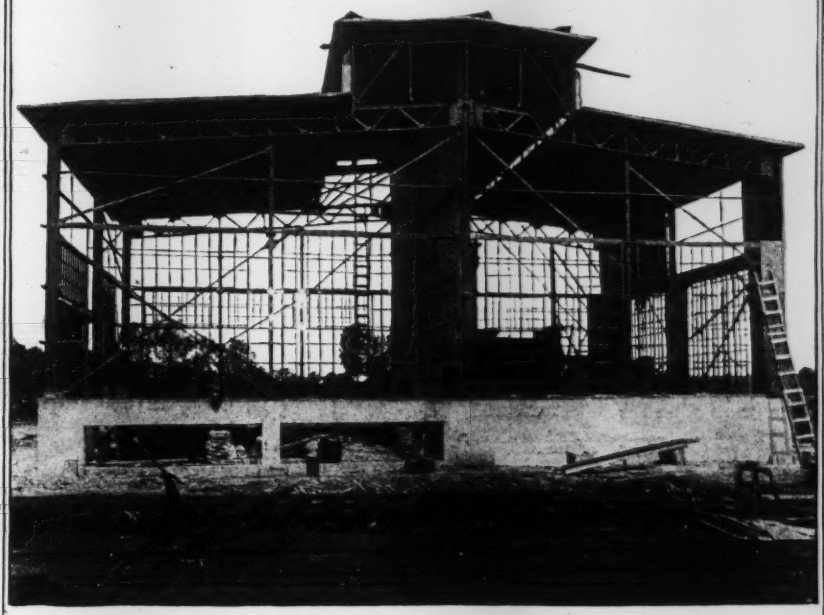

for the wet concrete, and becomes a permanent part of the finished structure. This type of construction saves labor because the large, stiff sheets are quickly and easily put in place, and the concreting is relatively simple.

In addition to all types of concrete roof and floor construction,

Self-Sentering

can be adapted to many special uses requiring either straight or curved forms. There is also a heavy demand for Self-Sentering on alteration and repair work.

Every engineer and architect should write today for our complete data on Self-Sentering.

The name of the GF dealer nearest you can be obtained by phoning Buyer's Aid, Inc., in cities of 70,000 or over. Ask them to send you the GF Catalog, or we will send it to you direct from the factory.

THE GENERAL FIREPROOFING CO.
Youngstown, Ohio
Manufacturers of All Types of Metal Lath, Concrete Reinforcements, Waterproofings and Technical Paints
Members of Associated Metal Lath Manufacturers
Branches: **New York Philadelphia Chicago San Francisco Kansas City Atlanta Cincinnati Buffalo Utica**

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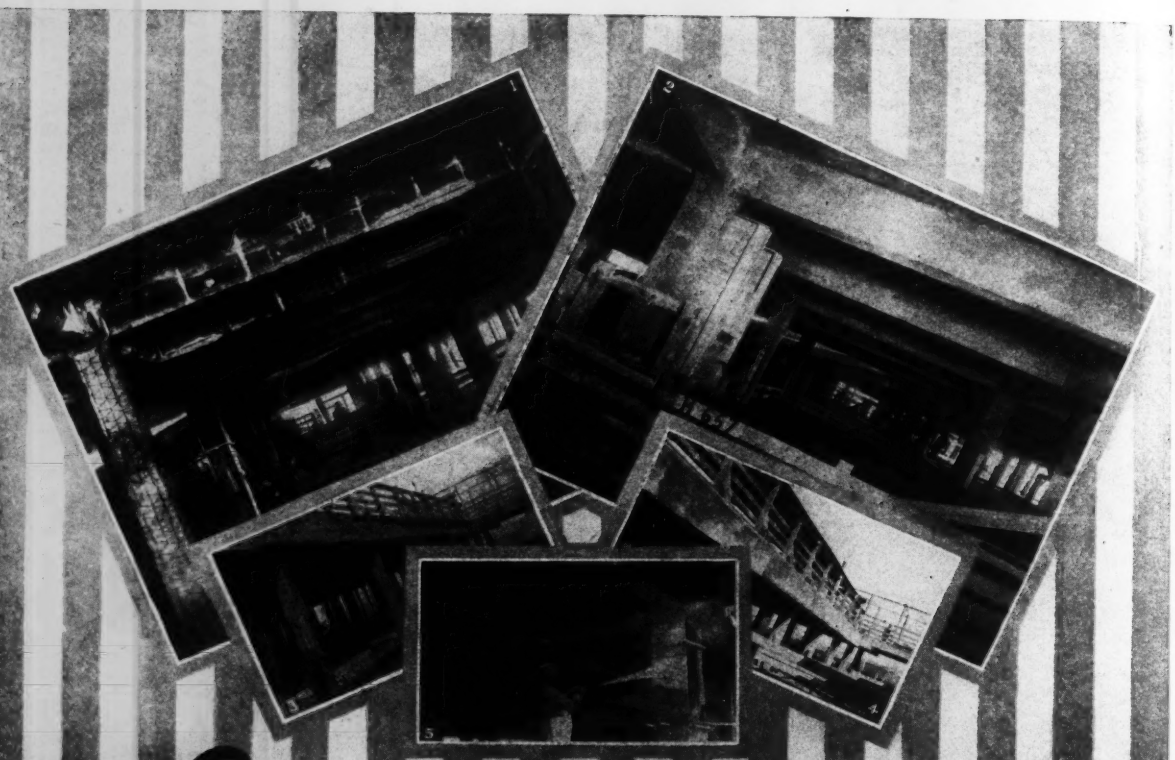


After the Fire—*Gunite it!*

A disastrous fire swept the Kansas City Stockyards about a year ago. Pictures 1 and 3 show its effect on the concrete hog stalls. Note the extremely scarred condition of the reinforced columns and girders. Nearly everywhere the flames bit through and beyond the steel reinforcing. It was a toss-up what to do—whether to employ a system of bracing, or dynamite the whole structure and rebuild. The Pratt-Thompson Construction Company of Kansas City was called into consultation. They at once mentioned the Cement-Gun, as the best possible agent of repair. Everybody agreed it was a severe test—that there seemed nothing else to do—so "why not try it out?"

Pratt-Thompson went ahead. A Cement-Gun Battery pulled into position and opened fire. The hiss of high-pressure "Gunite" began to sound from early morning till late at night. A transformation began to develop. Pictures 1 and 3 began losing their ugly scars until at the completion of the work they were no longer 1 and 3, but 2 and 4. Picture 5 shows how it was done. The problem was solved so simply with "Gunite"—the cement-sand product of the Cement-Gun—that the whole job hadn't the right to be called a real problem. Every bit of the repaired concrete is now stronger than before—because "Gunite" is twice as strong as concrete. It's driven into place with such force that its volume is reduced—fully one-half. And because the cement and sand mixture is untouched by water until it reaches the nozzle-tip—**the initial set occurs after the Gunite is in place.** Authorities agree that the full strength of cement was never fully developed before the advent of the Cement-Gun. Equally useful in Construction and Repair Work—no Contractor's Equipment is complete without one.

Your private information bureau needs a copy of "Cement-Gun-Shots". Why not send for your copy today?

CEMENT-GUN COMPANY, Inc., Allentown, Pa.

NEW YORK OFFICE, 30 Church St.
Taylor Engineering Co., 538 Central Bldg., Seattle, Washington.
R. E. Cleaton & Co., 20 St. Nicholas St., Montreal, Can.

CHICAGO OFFICE, 1414 Fisher Bldg.
Taylor Engineering Co., Vancouver, B. C.
General Supply Co., of Canada, Ltd., Winnipeg, Can.

A type of car that can be locked in a half dump position to facilitate hand loading

Steel Derricks

Industrial Cars

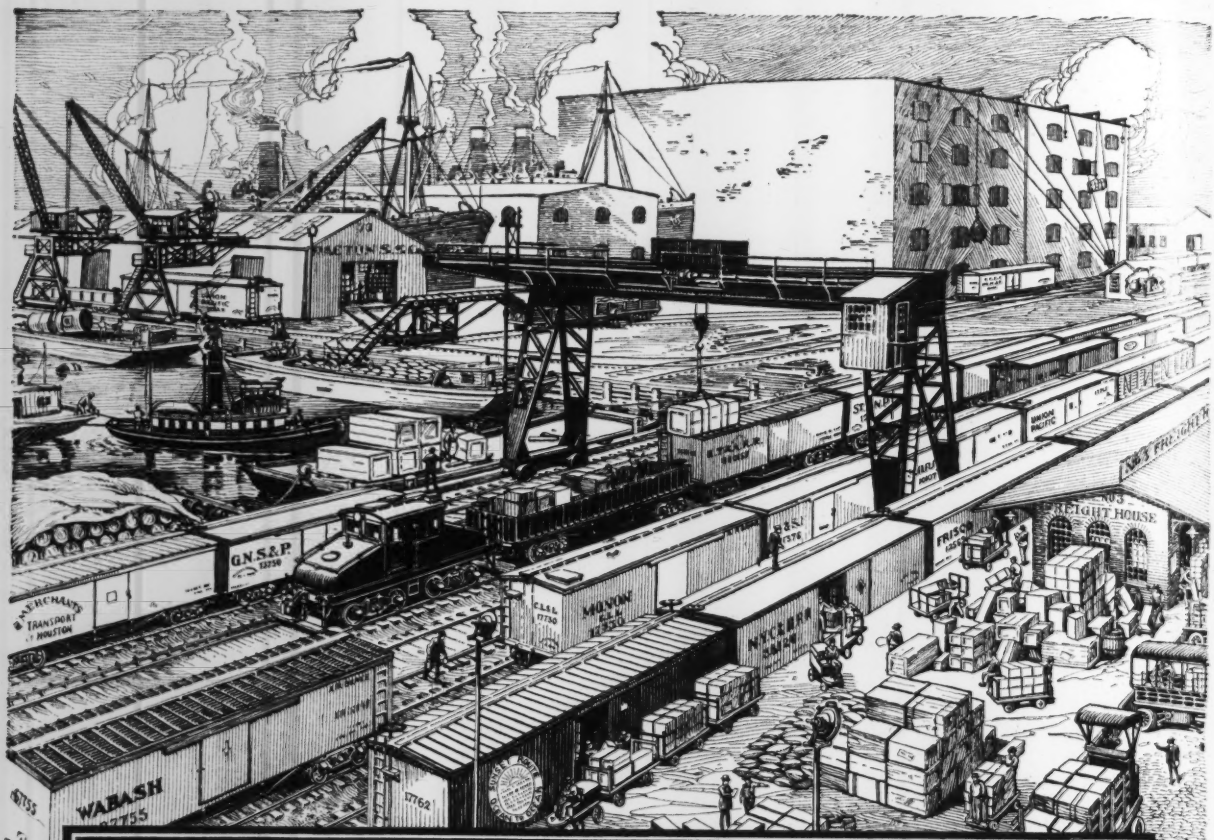
Concrete Placing Equipment

Insley Engineering Service has designed a large number of the concrete plant layouts that have been used on recent important Government construction projects. This same service is at your disposal.

INSLEY MANUFACTURING CO.

Engineers INDIANAPOLIS, INDIANA Manufacturers

NO. 16



Electricity Speeds Up Freight Handling

It is natural that after electric power so greatly speeded up the building and operation of our ships, the Panama Canal, Catskill Aqueduct and our mammoth office buildings, it should be used to speed up freight handling.

Electric power so used on docks has made one ship equal to two, has multiplied by seven the ore one man can produce and has added a seventh to the capacity of certain transatlantic ships.

Our terminals must be kept clear and freight speedily handled to develop American industry and commerce. Those terminals that have modern electrically operated freight handling machinery are always ready to promptly release freight cars and greatly reduce the turn around period of cargo ships.

Complete electrical equipment is supplied by the General Electric Company for the operation of dock equipment, ship propulsion and auxiliaries, freight transfer and classification yard machinery, and construction machinery.

Our enginers will be pleased to give you the benefit of their great experience in electrifying devices for multiplying man power.

General Office, Schenectady, N. Y. **Sales Offices in all large cities**

43-94

GENERAL ELECTRIC COMPANY

Get Your Wants into the Searchlight

ADVERTISING RATES

Ads Set in Uniform Style

(Solid, in one paragraph, without display.)

THREE CENTS A WORD, minimum charge 50 cents an insertion, payable in advance, less 10 per cent. If one payment is made in advance for four continuous insertions—for advertisements under:

Positions Wanted	Vacation Work Wanted
Evening Work	Tutoring
Wanted	Salesman Wants Connections

FIVE CENTS A WORD, minimum charge $1.50 an insertion, for advertisement under:

Agencies Wanted	Positions Vacant
Agents Wanted	Partner Wanted
Business Opportunities	Representations Wanted
Desk Room for Rent	Salesmen Wanted
Educational	Patents for Sale
Employment Agencies	Plants for Sale
Desk Room Wanted	Sub-Contracts Wanted
Foreign Business	Work Wanted

Miscellaneous for Sale, for Rent or Want Ads.

THIRTY CENTS A LINE, minimum five lines, for all undisplayed advertisements set with a paragraph for each item or tabulated.

THREE DOLLARS AND SIXTY CENTS AN INCH for advertisements for bids (Official Proposals).

Ads Set in Display Type

(Individual space, within border rules).

Space for these advertisements is sold by the inch. Each page contains 30 inches. The rate per inch is based on the *total* number of inches to be used—that is, the number of inches the advertisement is to occupy multiplied by the number of insertions it is to receive. For instance, a 2-inch advertisement in 2 issues earns the 4-inch rate of $3.90 a inch. A 1-inch space in 4 issues, or a 4-inch space in one issue, also earn the 4-inch rate.

SCHEDULE OF RATES

1 to 3 in., $4.00 an in.	15 to 26 in., $3.70 an in.
4 to 7 in., 3.90 an in.	27 to 49 in., 3.60 an in.
8 to 14 in., 3.80 an in.	50 to 99 in., 3.50 an in.

Rates for larger space furnished on request.

For quick and satisfactory results tell the reader everything that he will want to know.

INFORMATION

ALLOW FIVE WORDS for the address, if replies are to a box number in care of any of our offices. There is no extra charge for forwarding replies.

IN REPLYING TO ADS, do not enclose original testimonials or anything that you may want returned. State your experience and qualifications in as concise and neat a manner as possible and enclose copies of your testimonials.

BE CAREFUL TO PUT ON ENVELOPE, when answering any "blind," ad. the box number in the ad. the name of the paper, and also the local address of office to which reply is sent:

36th St., at 10th Ave.,	New York
1570 Old Colony Bldg.,	Chicago
657 Leader-News Bldg.,	Cleveland
935 Real Estate Trust Bldg.,	Philadelphia
501 Rialto Bldg.,	San Francisco
519 Newhouse Bldg.,	Salt Lake City, Utah

WHEN ADVERTISING MACHINERY, use your own name and address—or a local address of some kind—so that the readers can wire direct and get quick replies. We advise also that you state in your advertisement the present location of plant that is offered for sale, or point of delivery provided you are in the market for equipment.

TO SIGN YOUR NAME and address to your advertisement begets the confidence of the reader and facilitates receiving replies. You can, however, obviate delay in receiving answers by signing your ad. only with initials (your own or others), care of your home, your office or a post-office box number in your city.

DRAFTSMAN and ESTIMATOR

Medium sized plant of Structural and Ornamental Iron Work, Detroit, Mich., wants Chief Draftsman and Estimator. Address reply, stating experience, competency and salary desired, to

P137—Eng. News-Record
1570 Old Colony Bldg., Chicago, Ill.

DRAFTSMEN WANTED

For right-of-way and track maps in connection with Federal Valuation; also for concrete and structural bridge work. State age, nationality, experience and salary expected; submit sample of work.

H. R. Carpentier, *Chief Engineer,*
Missouri Pacific R. R. Co.
St. Louis, Mo.

Draftsman and Estimator Structural and Ornamental Iron-Work

Medium Sized Plant at Detroit, Mich.

Reply Stating—Age, Experience and Salary Desired

P87—Eng. News-Record
657 Leader-News Bldg, Cleveland, Ohio

POSITIONS VACANT

AN ESTABLISHED Canadian structural steel company has an opening in sales work for a 1915 or 1916 engineering graduate—one having had railway maintenance experience preferred. In replying, state age, nationality, education and experience. Reply to P-191, Eng. News-Record.

CHIEF draftsman wanted for structural and miscellaneous iron work. Employing four detailers. Give education, experience, age, salary expected and when able to report. Detroit concern. Apply P-140, Eng. News-Record, Chicago.

CIVIL engineer—Experience in railroad construction, surveying, drafting, for work in a sugar plantation in Santo Domingo. Replying stating experience, age and salary expected to Porcella, Vicini & Co., 59 Pearl Street, New York.

CLEVELAND engineer and general contractor has steady work for mechanical man on design of heating systems, power and general plant piping, etc. Give experience and salary wanted. P-221, Eng. News-Record, Leader-News Bldg., Cleveland.

COMPETENT chemist wanted; one thoroughly familiar with the distillation of tar oils. State experience and salary desired. The Jennison-Wright Company, Toledo, Ohio.

DESIGNING mechanical engineer, thoroughly experienced in design of cranes, coal and ore handling bridges and towers, coal screening and sizing equipments, shipbuilding and wharf cranes, coal tipple equipments, conveying machinery, etc. High-grade technical man wanted to take charge of design. State education, nationality, salary desired. Information confidential. Location, Canada. P-217, Eng. News-Record.

DESIGNING engineer wanted to design and detail structural steel and reinforced concrete. Give full record of experience, references and when you could report for duty. Salary $125 to $150, depending upon experience. Address Chief Engineer, Ingalls Iron Works Co., Birmingham, Ala.

DRAFTSMAN wanted, paper mill work. Permanent position. $125.00 to start. Address P-218, Eng. News-Record, Phil.

DRAFTSMEN to plot notes and make standard tracings for railroad valuation work. Must be neat, quick, reliable and submit samples of work. Salary, $160.00. 25 Conestoga Building, Pittsburgh, Pa.

POSITIONS VACANT

DRAFTSMEN and detailers wanted for industrial plant layout work, preferably men with experience in elevating and conveying machinery. State age, education, nationality, previous experience and salary desired. P-143, Eng. News-Record, Philadelphia.

ELECTRICAL draftsman wanted; experienced, familiar with industrial plant layout; electrical knowledge essential; permanent position. P-226, Eng. News-Record.

EXPERIENCED bridge detail draughtsman wanted. Virginia State Highway Commission, Richmond, Va.

HIGH GRADE master mechanic wanted for medium sized Meat Packing Plant. Address P-819, Eng. News-Record, Chicago.

Get your copy in early—

Owing to the holiday next week, the forms for the Searchlight Section of the

JAN. 2nd ISSUE

of

ENGINEERING NEWS-RECORD

will close for press at 4 P. M., December 30.

POSITIONS VACANT

INSTRUMENT men, and draftsmen wanted for field surveys in a Southern State. P-184, Eng. News-Record, Philadelphia.

INSTRUCTOR to teach civil engineering subjects by correspondence, in an Eastern city. Position permanent for one who can qualify. State education, experience and initial salary expected. P-224, Eng. News-Record, Philadelphia.

INSTRUCTOR to take charge of materials, testing laboratory and to teach mechanics in a technical school of recognized standing in New York City. A graduate of a technical school with both practical and teaching experience preferred. Give outline and experience and references. Technical, P-227, Eng. News-Record.

We Want the Following Men

Applications should be in writing and accompanied by experience record. Sober and ambitious men only apply. The best are none too good.

FOREMAN for Plate Shop now doing ship work; in ordinary times, general plate work, such as tanks, bins and refinery equipment. Must be a master of most complicated layout and handling men.

INSPECTOR for Structural Shop. Young technical man preferred.

SHIPPING CLERK for Fabricating Shop.

Memphis Steel Const. Co. of Penna.
Greensburg, Pa.

Advertising Manager

One of the biggest advertisers in the construction field is looking for a man to take entire charge of its advertising work. A knowledge of trade and popular magazines, mail, convention and catalog work is required.

Hard work and initiative are two prime requisites — ample salary with a future in a fast growing organization are assured to the right man.

Appointment in New York or Middle West.

Your experience in building field as well as in advertising will be of interest to

P200—Eng. News-Record
657 Leader-News Bldg., Cleveland, O.

DRAFTSMAN
WANTED

One good checker and draftsman, experienced on rubber machinery, for newly organized department.

THE WELLMAN-SEAVER-MORGAN CO.
7000 Central Ave., Cleveland, Ohio

POSITIONS VACANT

GENERAL manager for a small structural fabricating shop, capacity 200 to 300 tons per month. Located in Middle West. Man under 40 years preferred. Must give good reference, be capable of taking full control of business. State experience and salary desired. P-222, Eng. News-Record, Leader-News Bldg., Cleveland.

JUNIOR (civil) engineers for work on subway construction, New York City; provisional appointments pending examination; entrance salary, $1501 per annum, with opportunities of advancement; two years' construction experience required; technical graduates preferred; open to citizens only. Apply, giving full information as to education and experience to the Public Service Commission, 49 Lafayette Street, New York City.

MECHANICAL draftsman wanted with technical university training or equivalent. Good experience in layout and details of combined mechanical and structural work. Able to handle machinery on cranes, conveyors, swing bridges or sluice gates, etc. Must be a thoroughly capable man who can work without constant supervision and produce results quickly. Apply Chief Mechanical Draftsman, Dominion Bridge Company, Limited, Montreal, P. Q.

SALES engineer for Pacific Northwest to handle fireproofing and reinforcing materials for building construction. Must be young man, technical college graduate; permanent position. P-190, Eng. News-Record, Rialto Bldg., San Francisco.

POSITIONS VACANT

MECHANICAL engineer with experience in cement industry wanted for large cement plant in East. State past experience and salary expected. P-225, Eng. News-Record, Philadelphia.

SUPERINTENDENT or assistant superintendent wanted, who has had considerable mill and quarry experience to take charge of a large lime and stone crushing plant. Must be a hustler and good practical man able to handle several hundred men. Splendid opening for the right man with an excellent future. Man with cement mill experience preferred. State fully previous experience, reason for desiring change, and salary expected. P-223, Eng. News-Record, Philadelphia.

SUPERINTENDENT wanted; capable to take charge of creosoting plant in Northern state, treating 500,000 to 750,000 ties per year. State experience and salary wanted. P-54, Engineering News Record, Philadelphia.

TRANSITMAN wanted on highway construction. Must be able to assist in office on plotting and computing earthwork, as well as being an accurate field man. Salary, $110.00 per month. P. A. Early, Engineer for County Court, Welch, W. Va.

EMPLOYMENT AGENCIES

TEACHERS wanted. The Interstate Teachers' Agency, Macheca Bldg., New Orleans, La., recommends teachers in all departments of engineering for college and university positions. Special terms offered.

ASSOCIATION EXECUTIVE
WANTED

An association composed of all the recognized manufacturers of a standard building material wants a high-class executive to act as commissioner. Must have practical knowledge of building construction—and preferably a technical education. Must have had wide experience and acquaintance with the building trade—must be able to meet with the biggest and the smallest men in the business—to handle men—and to act as absolute leader in the promotion and development work of the industry.

This is a big job for a big man. No others need apply.

P174—Engineering News-Record
1570 Old Colony Bldg., Chicago, Ill.

For some time we have been improving the Construction News section of the ENGINEERING NEWS-RECORD. That we are not yet satisfied is proved by this advertisement. At least

40 CORRESPONDENTS ARE WANTED

who are in close touch with construction work and can devote a little spare time during business hours to gathering reports. Representatives are wanted in the following centers:

Atlanta, Ga.	Kansas City, Mo.	Pierre, S. D.
Augusta, Me.	Lansing, Mich.	Quebec
Birmingham, Ala.	Lincoln, Neb.	Reading, Pa.
Carson City, Nev.	Little Rock, Ark.	Richmond, Va.
Chattanooga, Tenn.	Lowell, Mass.	Sacramento, Cal.
Cheyenne, Wyo.	Montgomery, Ala.	Sioux City, Ia.
Concord, N. H.	Montreal, Que.	Spokane, Wash.
Erie, Pa.	Newark, N. J.	Tallahasse, Fla.
Hartford, Conn.	New Orleans, La.	Topeka, Kan.
Helena, Mont.	Oklahoma, Okla.	Toronto, Ont.
Jefferson City, Mo.	Omaha, Neb.	Trenton, N. J.
Jersey City, N. J.	Ottawa, Ont.	Vancouver, B. C.
Johnstown, Pa.	Phoenix, Ariz.	Worcester, Mass.

Write—telling all about your present work and how much time you have available—to

L. V. FLETCHER
Engineering News-Record, 10th Ave., at 36th Street, New York

EMPLOYMENT AGENCIES

THE ENGINEERING AGENCY, the oldest technical employment bureau in the world, now in its twenty-sixth successful year, has positions open for engineers and draftsmen. Particulars furnished free on request—no advance fee if you mention this advertisement. 1662 Monadnock Bldg., Chicago, Ill.

Employment Service

THE undersigned provides a confidential service designed to locate openings through correspondence for men earning not less than $2,500 and up to $25,000, all lines. Not an employment agency but a constructive, initiative service, covering individual negotiations. Established 1910. Complete privacy assured; present connections in no way jeopardized. Send name and address only for explanatory details. R. W. Bixby, T64-66 Niagara St., Buffalo, New York.

POSITIONS WANTED

Mechanical and Electrical

CAPTAIN of Engineers, U. S. Army, wants position about Feb. 1. College graduate, married, 10 years' experience in mechanical and electrical engineering and manufacturing, of which last 4½ have been executive work. Reply PW-49 Eng. News-Record.

ELECTRICAL engineer, familiar with erection and operation of power plants, industrial installations, electrical and mechanical transmission of power, cable and signal work, capable of handling men, will shortly be available for a position requiring an aggressive, competent and experienced executive. PW-157, Eng. News-Record.

MECHANICAL engineer (38); technical school and 15 years' experience, mainly mill engineering, including buildings. Can design important work. PW-782, Eng. News-Record.

THE CORNELL SOCIETY OF CIVIL ENGINEERS

Maintains a Registration Bureau

Complete records of 2000 Cornell men are on file. Employers may consult these records without charge. Address

REGISTRATION BUREAU
30 East 42nd St., New York
Room 916 3075 Murray Hill

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad. and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
657 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
519 Newhouse Bldg., Salt Lake City.
501 Rialto Bldg., San Francisco.

Importan

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

POSITIONS WANTED

GRADUATE mechanical engineer desires position for immediate acceptance; was formerly with engineering corps of U. S. Army, has been assistant chief engineer for New York corporation for the past year, but owing to cancellation of contract must find position elsewhere; has executive ability and prefers work in South America; can speak English PW-246, Eng. News-Record.

MECHANICAL engineer, M. Am. Soc. C. E., extensive experience on design, construction and operation of dredging, excavating, hoisting and conveying machinery. Now engaged. Available on short notice. PW-926, Eng. News-Record.

MECHANICAL engineer with technical education and 13 years' experience in designing, selling, estimating and on construction work as field engineer in power plant, heating and ventilating, sanitary and plumbing work with architects and contractors will be open for engagement about Jan. 1. Salary, $4000 to $5000, depending on conditions. PW-142, Eng. News-Record, Philadelphia.

MECHANICAL engineer with M. E. degree. Age 31, not married. 8 years' experience on general structural design, inspection work construction of large mining plants and also experienced in the buying and selling of machinery. 4 years were spent in So. America so am familiar with the language and business in that country. Would like to join a firm where my technical knowledge of foreign business would be of service. Am now a captain in the service but expect a release shortly. PW-233, Eng. News-Record.

POSITIONS WANTED

MECHANICAL engineer, now on chief engineer's staff of a war industry, desires connection where hard work and ability to organize and devise methods to produce results will be appreciated. PW-927, Eng. News-Record.

MECHANICAL engineer, draftsman, technical training, 15 years' experience general and special machine designing also reinforced concrete, and general engineering construction, open for position. Would be valuable to engineering and contracting company or concern contemplating improvements or extension to plant and equipment. PW-209, Eng. News-Record.

MECHANICAL engineer, assistant superintendent plant maintenance and production, construction, purchase and installation of electrical machinery and factory equipment, design and upkeep power plants, handle men, business experience, responsible position desired, salary, $200 month, location New York City or vicinity. PW-207, Eng. News-Record.

Civil Engineers

AVAILABLE at once, graduate civil engineer, 9 years' field and office experience, factory design, construction, equipment and maintenance. PW-135, Eng. News-Record.

CHIEF of party, college education, 27 years' old, married; 5 years' varied construction experience, accurate surveys, town layout, executive ability. PW-231, Eng. News-Record.

CIVIL engineer, technical education, 4 years' experience inspection work, checking estimates, drafting; discharged as sergeant, desires work along engineering lines. PW-232, Eng. News-Record.

CIVIL engineering graduate, 8 years' experience on subway, highway, canal and railroad work, both field and office, desires position. Had charge of responsible work and management of office. PW-212, Eng. News-Record.

CIVIL engineer, Columbia graduate, 28 years old; married; Lieutenant of Engineers, U. S. Army, recently honorably discharged, 4½ years' experience in subway, tunnel, and building construction; also experience in surveying, designing, estimating and cost accounts; will go any place. Interview can be arranged in New York. PW-211, Eng. News-Record.

Going Up?

Designers of Steel and Concrete Construction are scarce. The country—yes the whole world—needs trained men and needs them quickly for the work of reconstruction. There are wonderful opportunities for the man who takes the trouble to equip himself for the race of success.

WANTED DESIGNERS OF CONCRETE AND STEEL

Special Courses of Home Study have been arranged by a well-known Engineer with 30 years' experience. These courses give actual experience in Designing and Estimating the cost of Steel and Concrete Structures in the shortest possible time. Because they are the practical demonstrations of an engineer of long and successful experience—these courses open a real opportunity to the ambitious man who wants to get ahead. Also a course in Structural Drafting.

YOU can fill that need!

Write today for information.

M-1006—Eng. News-Record
10th Ave. at 36th St., New York, N. Y.

Your Advancement

is largely in your own hands—it is doubtful if anyone else is worrying over it

Better positions are constantly being secured through small advertisements in the "Positions Wanted Columns."

60 cents for 20 words

POSITIONS WANTED

CIVIL engineer, 25; technical graduate; experienced in design of elevating and conveying machinery and structural steel. A1 draftsman. Would like position affording opportunity for design or construction of reinforced-concrete. Location immaterial. PW-215, Eng. News-Record, Chicago.

CIVIL engineer (30), technical education, 6 years' experience on construction and surveys, wishes similar position. F. W. Conway, 413 Central Ave., Jersey City.

CIVIL engineer graduate, 3 years' experience reinforced concrete, recently with ordnance department, desires connection with plant, or on construction. PW-242, Eng. News-Record.

CIVIL engineer, age, 38; now with one of the leading engineering firms, wishes executive position; 16 years' experience in supervising, designing and estimating construction work of all kinds embracing reinforced concrete, structural steel, masonry, etc. PW-244, Eng. News-Record.

CIVIL engineer, 1917 graduate, married. Since graduation commissioned in the field artillery, U. S. Army. Desires municipal or highway position in the East. Best references; least salary, $100.00 per month. Swanton, Vt., P. O. 12.

CIVIL engineer, graduate, 13 years' field and office experience, including supervision of design and construction. Industrial plants, equipment, railroad, municipal, steel, reinforced concrete. PW-241, Eng. News-Record.

CIVIL engineer (graduate) released from military service desires responsible position. Have had and in charge of designing, estimating and superintendence of fireproof structures. PW-205, Eng. News-Record.

CIVIL engineer, technical graduate, 31, married, 6 years' experience field and office; draftsman, instrumentman, contractors engineer; capable, energetic, reliable; wishes to become permanently located on responsible work where ability is recognized by advancement. Employed. Best references. PW-234, Eng. News-Record, Chicago.

CIVIL engineer, 31, engineer officer in Amer. forces 15 months. Speaks French perfectly, including technical. Would accept suitable position in America or Europe on engineering construction, purchasing or selling. Address PW-237, Eng. News-Record.

CIVIL engineer, Rensselaer Polytechnic graduate, 4 years' field experience, estimates, designing, etc.; also experience in water supply; can report within two weeks of acceptance. PW-103, Eng. News-Record, Philadelphia.

CIVIL engineer, graduate, army officer about to be discharged, 32, 8 years' experience designing, estimating, superintending steel mill, concrete and timber construction. Will go anywhere, prefer France or India. PW-193, Eng. News-Record, Philadelphia.

CIVIL engineer and superintendent of construction, member Am. Soc. C. E., will be open for new engagement in January; $2400-$3000. Address Box 324, Passaic, New Jersey.

CIVIL engineer (27), 5 years' experience superintending, selling, designing, estimating, reinforced concrete buildings. PW-188, Eng. News-Record.

CIVIL engineer, 33 years old, married, with the following experience, railroad reconstruction, designing in reinforced concrete, general estimating and as superintendent of building construction, harbor improvements and dredging, wishes to connect with some live and growing contractor in central south as Tennessee. Salary no object, but chance for advancement is. Reply J. Box 438, Edgewater, New Jersey.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad. and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
657 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
519 Newhouse Bldg., Salt Lake City
501 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

POSITIONS WANTED

CIVIL engineer, 4 years' bookkeeping, estimating, costs, 6 years chief of party, shift engineer in charge subways, subaqueous and rock tunnels, 6 months' designing, estimating reinforced concrete. PW-976, Eng. News-Record.

CIVIL engineer, technical education (sanitary engineering), 7 years' experience in the municipal field as city engineer and also in consulting capacity; experienced in design, layout, and supervision of construction. Especially capable report writer. Will take position as city engineer or manager, designing engineer, or will connect with public health department. Age 30, married; available Jan. 1. PW-21, Eng. News-Record, Chicago.

CIVIL engineer, graduate, 20 years' experience in Irrigation, drainage, levees, sewers, water-works, topography, surveys; at present first lieutenant, Engineers, U. S. A.; salary, $3500. PW-24, Eng. News-Record.

CONSTRUCTION engineer, 33, technically educated. 12 years' experience on railroad, highway, municipal engineering and building construction, as engineer or superintendent. State salary. Excellent references. W. S. C. Box. 213, Henderson, Ky.

ENGINEER, associate member A. S. C. E., age 38, 12 years' experience railroad preliminary surveys, location and construction, including terminals, construction of docks, piers, bulkheads and difficult foundations. Available Jan. 1. PW-15, Eng. News-Record.

ESTIMATOR, experienced, graduate civil engineer, good business training, desires position with road or building contractor; prefer New York location with small concern offering opportunity to advance. PW-203, Eng. News-Record.

FIRST lieutenant, engineers, U. S. Army, just discharged, 37, widower; 16 years' experience highways, sewers, water and general municipal engineering. Position as city, county or highway engineer. Available now. PW-197, Eng. News-Record, Leader-News Bldg., Cleveland.

GRADUATE civil engineer, married, 4 years' experience, plant construction and maintenance, design and estimation of reinforced concrete structures, desires position with contractor or industrial plant. PW-251, Eng. News-Record, Philadelphia.

GRADUATE civil engineer, 4 years' experience, open for position in Europe after discharge from American Expeditionary Force. PW-192, Eng. News-Record, Chicago.

GRADUATE civil engineer, unmarried, 13 years' varied experience in field and office; captain Engineers, U. S. A.; desires opening in South upon discharge Jan. 1. PW-185, Eng. News-Record, Philadelphia.

GRADUATE civil, experienced construction engineer, supervision, surveyor, computer, draftsman. Responsible charge railroad construction, municipal and townsite improvements and developments. W-57 Washington Ave., Rutherford, N. J.

GRADUATE civil engineer with 13 years' practical experience on checking, designing, field inspection and erection of railroad bridge, desires to make a change where there is opportunity for advancement. Present salary $2400. PW-769, Eng. News-Record, Philadelphia.

POSITION WANTED

ELECTRICAL AND MECHANICAL ENGINEER

of sixteen years' experience in construction, operation and maintenance of industrial plant equipment, just returned from an engagement in the Orient, desires responsible executive position with manufacturing company or connection with firm of consulting engineers. Has had broad engineering experience, is good organizer and competent to handle important work.

PW170—Eng. News-Record
10th Ave. at 36th St., New York City

(CONSTRUCTION MANAGER OR GENERAL SUPERINTENDENT) WILL BE OPEN FOR POSITION JANUARY 1, FIRST CLASS EXECUTIVE; 15 YEARS' EXPERIENCE ALL BRANCHES OF CONTRACTING WORK. SALARY AND PERCENTAGE BASIS PREFERRED. ADDRESS P. O. BOX 42, EAST LIBERTY STATION, PITTSBURGH, PA.

POSITION WANTED

by Constructing Engineer (C.E.), with contractor or manufacturer; 20 years' experience. Specialty

Designing and Superintending Construction
BUILDINGS

for manufacturers, railways, municipalities, etc. Location immaterial. Recently

Captain, Engineers, U. S. Army

Address

PW176—Eng. News-Record
10th Ave. at 36th St., New York City

STRUCTURAL AND CIVIL ENGINEER AND SUPERINTENDENT

Now Chief Engineer of a $10,000,000 war plant, wishes to make new connectionsas importance of present position has ceased. Experienced as office or field manager, designer, estimator, specifications. Expert in reinforced concrete, steel, mill or timber construction, refining or chemical works. Technical graduate with good knowledge of chemistry. 20 years' experience, good references. Salary, $4000 in U. S. Can go anywhere, and speaks and writes French freely.

PW204—Eng. News-Record
10th Ave. at 36th St., New York City

CIVIL ENGINEER

In present position eight years, desires change. Age 35, American citizen, married.

EXPERIENCE

Sixteen years on railroad construction and maintenance. About eighteen months ago was promoted from Engineering Department to Assistant Land Commissioner of one of the largest Railroad Systems in America.

Past record will bear the closest scrutiny.

Interview can be arranged at Buffalo, Boston, Detroit or New York.

PW199—Eng. News-Record
10th Ave. at 36th St., New York City

POSITIONS WANTED

GRADUATE civil engineer, 5 years' experience, married, 30 years of age, will be open for employment on Jan. 1; salary, $200 per month; can furnish best references. PW-23, Eng. News-Record.

GRADUATE C. E., 36, married, capable, 16 years domestic experience in structural steel, timber, and concrete design and sales work. Assistant Ry. Bridge Engineer (6 years). Expects discharge from army (major engineers) in January. Good references. Will go anywhere. L. R. Muhs, 1631 Leland Ave., Chicago, Ill.

GRADUATE civil engineer with 20 years' experience desires position as engineer, superintendent of construction or operating of railroad. Have had experience in all above work. Can give good references. PW-229, Eng. News-Record.

HYDRAULIC engineer, 5½ years' experience design and supervising hydraulic power, water, sewers, general industrial construction. Designed sixty million gallon pumping station; government explosives plant. J. A. Wade, 410 E. 3rd St., Flint, Michigan.

MAN with civil engineer's training wants position to assist on designs of steel and reinforced concrete construction where he can get practical experience of what he has learned theoretically. Can design and compute stresses in beams, girders, columns, roof and bridge trusses, retaining walls. Understands railroad problems, curves, earthwork, etc. Fair draftsman and field man. PW-148, Eng. News-Record.

PRIVATE in U. S. A., expecting his discharge, desires responsible position. Technical education and 8 years' experience as engineer and designer on buildings and equipment for large industrial plants. Experienced in steel, reinforced concrete and timber construction, conveying machinery, water supply, general plant layout, etc. Has executive ability and organizing talent. Address Pv. Herbert Goldstein, Post Hospital, Fort Myer, Va.

RAILROAD engineer, 35; graduate of prominent Eastern technical school; 10 years' experience in construction and maintenance work, formerly connected with large Eastern trunk line as construction engineer, inspector of bridges and buildings, chief draftsman, office engineer and assistant division engineer, desires responsible position with railroad or industrial concern. PW-208, Eng. News-Record, Philadelphia.

RAILWAY civil engineer, graduate, 8 years' experience railway location, construction, maintenance and valuation. Just released from engineer corps. PW-248, Eng. News-Record, Chicago.

RAILWAY maintenance and construction engineer, 16 years' field and office experience, main line and terminals, roadway, track, structures, signals, docks, wharves, track layout, design, good executive; salary, $200.00. PW-243, Eng. News-Record, Philadelphia.

TECHNICAL graduate, instrument man, inspector, 4 years' practical experience in field work and big construction jobs. PW-239, Eng. News-Record.

12 YEARS' engineering construction experience, executive positions including superintendent, general superintendent, manager, contractors; graduate C. E. Just arrived from France returning to civil life from major artillery. Interview. PW-146, Eng. News-Record.

Bridge and Structural

REINFORCED concrete specialist, 15 years' general practice as engineer in charge of design and construction and as contractor's superintendent. Have had extensive experience in handling men and actual practice in operating both gas and steam machinery. As a draftsman I can turn out a good, legible working plan. In designing I have the ideas to do things on my own initiative. I can insure the fullest cooperation in their work to anyone who needs an executive along these lines. Address PW-53, Eng. News-Record.

Partnership in Engineering Firm

wanted by Engineer who is fully capable of holding up his end in every way.

Mem. Am. Soc. of C. E., age 37, experienced in design of buildings, bridges, etc., in steel, wood and concrete. Also, difficult foundations, piers, docks and other waterfront construction.

Eight years' contracting experience as officer of well-known construction company. Particularly experienced in securing new business, drawing and handling contracts and general executive work. At present, Supervising Engineer on large Government project.

Correspondence Invited

PW220—Eng. News-Record
935 Real Estate Trust Bldg., Philadelphia, Pa.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad. and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
657 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
519 Newhouse Bldg., Salt Lake City.
501 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

POSITIONS WANTED

AVAILABLE Jan. 1, a crew of 5 A1 reinforced steel men; 2 men competent and qualified to take full charge of both concrete and steel on either large building operations or concrete ship construction. First class references, also figures to show we produce results. Not afraid of work or weather. PW-62, Eng. News-Record.

STRUCTURAL engineer, draftsman, technical graduate, married, 10 years' experience in estimating, design, detail and field work on mill buildings, bridges, etc.; have spent 1 year in Spanish speaking country, open to responsible position in office, field or sales department. PW-150, Eng. News-Record.

STRUCTURAL engineer, 43, graduate C. E., 18 years' experience in designing, estimating, checking steel, concrete, timber construction, 2 years with contractor, 2 years approving steel details in connection with heavy construction, will be open for engagement by Jan. 1. PW-194, Eng. News-Record.

STRUCTURAL engineer, thoroughly competent, experienced in practical designing, and checking of reinforced concrete, steel and timber structures, available during part of regular working hours. Member of teaching staff in civil engineering department of prominent university. PW-250, Eng. News-Record, Philadelphia.

Draftsmen

COKE ovens; first-class draftsman, designer for coke ovens, boiler settings, special furnaces for chemical work, pots and still settings, dryer, factory buildings, etc., with 20 years' field and office experience seeks change for advancement; best references. PW-228, Eng. News-Record.

POSITIONS WANTED

STRUCTURAL draftsman and designer, technical graduate wide experience in all kinds of construction. PW-136, Eng. News-Record.

ARCHITECTURAL draftsman with extensive experience in manufacturing, buildings, design, supervision, specifications. Specially qualified to handle job correspondence and executive end of drafting rooms. PW-230, Eng. News-Record.

DRAFTSMAN, 25; technical graduate in C. E. Experienced in design of elevating and conveying machinery and structural steel. Would like position affording opportunity for design or construction of reinforced-concrete. Location immaterial. PW-214, Eng. News-Record, Chicago.

DRAFTSMAN, 14 years' experience machine design, reinforced concrete, general construction, technical training, wants position where good engineering ability can be utilized. PW-210, Eng. News-Record.

STRUCTURAL draftsman, first-class, 16 years' experience as checker and squadman with leading companies; shop inspection and erection experience, desires position employed. PW-247, Eng. News-Record, Philadelphia.

YOUNG capable engineer, successful designer of industrial plants, steel, reinforced-concrete, timber, plumbing. Full charge of design and construction. Address PW-201, Eng. News-Record.

Superintendent

CONSTRUCTION manager or general building superintendent capable of earning from $6000 to $10,000 yearly would like to get connected with some good construction company. South or central West preferred. PW-966, Eng. News-Record, Philadelphia.

CONTRACTOR'S superintendent, good education and ability to organize, handle work and large forces of men; 15 years' experience in all classes of paving, road work and steam shovel excavation. Age, 39; best of references; will go any place. PW-158, Eng. News-Record.

EXPERIENCED general foreman or superintendent wants charge of track. Rock, steam shovel or building concrete work. PW-249, Eng. News-Record.

POSITIONS WANTED

EXPERIENCED man wants charge as superintendent or inspector of public, industrial or development work. PW-178, Eng. News-Record.

GENERAL foreman, 20 years' experience on deep foundations, sewers, bridges, trestles, roads, forms, reinforced concrete, etc. Go anywhere. PW-130, Eng. News-Record.

POSITION as superintendent by practical man of broad and varied experience in construction work, familiar with construction and operation of heavy land and floating plant, particularly hydraulic dredges and harbor improvements generally. Good organizer and executive. Can furnish references as to character and capability. Open for engagement Feb. 1. Location no object. PW-144, Eng. News-Record.

POSITION wanted as general carpenter foreman or assistant superintendent on reinforced concrete construction. Prefer an European engagement. Discharged army officer, will be available about Jan. 1st. PW-235, Eng. News-Record.

REINFORCED CONCRETE. Am a graduate engineer, 34 years of age, a carpenter by trade, have specialized in sup ervision of reinforced concrete building construction and am an efficient organizer and a business builder. I desire connection with responsible firm of contractors or construction engineers who will give me an opportunity to prove my ability and value and pay accordingly; salary basis with commission preferred. Am at present employed in war work and available two weeks after notifying present employer. New York and vicinity preferred but due consideration will be given other localities. PW-95, Eng. News-Record.

REINFORCED concrete foreman desires employment in Mexico, Cuba or Central America; married; speaks Spanish; energetic worker. PW-219, Eng. News-Record, Chicago.

SPANISH America; foreman, 46, 13 years' experience in building construction, machine erection and tropical sanitation; speaks Spanish; references as to sobriety and ability. PW-52, Eng. News-Record.

SUPERINTENDENT, 10 years' practical experience on all classes of concrete and steel buildings, both municipal and private, also heavy excavation and mass concrete on general construction work. Up-to-date methods on own initiative and good organizer in field. Can estimate and purchase material. No line drawn on hours or work to get results. Married, age 29, strictly temperate. Present pay, $350. Permanent place with responsible party will receive consideration at smaller salary depending on location. Prefer U. S. or Canada. PW-63, Eng. News-Record.

SUPERINTENDENT of building construction. 25 years' experience as draftsman estimating and handling large forces of men in all crafts. Go anywhere. Would like to get connected with some good construction company. PW-236, Eng. News-Record.

SUPERINTENDENT experienced in steam shovel dredging and drainage ditch work; several years' experience with nearly all classes of excavating machinery. Reliable and willing to go to any country. PW-216, Eng. News-Record.

SUPERINTENDENT, 42, over 20 years' practical experience on heavy construction; tunnels, sewers, deep foundation river and heavy timber work of kinds; underground. Difficult excavation; reinforced concrete a specialty; best of references. PW-245, Eng. News-Record.

In Replying to "Blind" Ads

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10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
657 Leader-News Bldg., Cleveland.
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519 Newhouse Bldg., Salt Lake City.
501 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

POSITIONS WANTED

SUPERINTENDENT of construction; first-class executive, broad experience; difficult foundations, locks, dams, bridges, building and industrial plant construction; concrete a specialty PW1001—Eng. News-Record.

SUPERINTENDENT or manager, graduate C. E., 10 years in positions of responsible directive capacity, desires opening in general construction or in charge of plant for manufacturing concern. Accustomed to construction of industrial plants, bridges, docks, dams, roads, etc. Past year in responsible charge of proposition involving about $2,000,000. Opportunity for conference with all past connections extended. Personal interview required. Available Dec. 15. PW-82, Eng. News-Record.

SUPERINTENDENT — Associate member A. S. C. E., age 38, 12 years' experience heavy construction work, docks, piers, sea walls, dredging shipways and housing jobs. Present work nearing completion. Available on short notice. PW-14, Eng. News-Record.

SUPERINTENDENT, 18 years' experience on all kinds of contract work, heavy steam shovel work, grading, highway construction, sewers, concrete, plain and reinforced; good organizer and can produce results. Best of reference. PW-122, Eng. News-Record.

SUPERINTENDENT of construction, 14 years' broad experience. If interested ask for letters of recommendation and interview. Age 36. PW-149, Eng. News-Record.

SUPERINTENDENT or resident engineer, working, 18 years' experience in charge steel erection, reinforced concrete, hydraulic and submarine masonry, and wide experience in general construction. Position in southern U. S. or tropics preferred. Speak Spanish. PW-132, Eng. News-Record, Philadelphia.

Miscellaneous

AMERICAN, mechanical and structural engineer, age 38, desires hard job as maintenance engineer or master mechanic. Earnings, $300. PW-153, Eng. News-Record, Chicago.

ARCHITECTURAL designer and draftsman; 5 years' designing and general construction experience with architects and engineers; university graduate, desires position as architectural designer or as superintendent of construction. Officer honorably discharged from U. S. Army. PW-202, Eng. News-Record.

CAPTAIN Engineers, just discharged, aged 38, married, with 16 years' experience as sales engineer and branch manager in machinery and steel cable industry, desires similar position. PW-131, Eng. News-Record, Chicago.

POSITIONS WANTED

ASSISTANT engineer, 26 years, desires position with general contractor or building material concern; 6 years' experience at electrical conduit subway, 1 year on rapid transit subway construction also 6 months as general foreman. Accustomed to handling men. Office experience. Salary desired, $175 per month. PW-234, Eng. News-Record.

DESIGNING engineer with wide experience in electric machinery, switchgear, station layouts, steel, brick and concrete structures and general mechanical apparatus, at present with large chemical company, desires change; responsible position with established concern only. PW-181, Eng. News-Record.

ENGINEER, 30, married, desires responsible position; experienced in all classes surveys, railroad M. W. and construction, grade separation, yards and terminals, estimates and reports, field and office; year in Spanish America; available immediately. PW-70, Eng. News-Record, Leader-News Bldg., Cleveland, O.

EXECUTIVE with 10 years' practical experience in manufacturing and constructing lines. Have held positions of responsibilty on 4 large U. S. Government contracts during the war. Energetic, resourceful and well experienced in business diplomacy. Have handled large numbers of men. Am willing to consider offer from responsible party or parties anywhere in the United States. Age 30 years, married. Address 567 West Second St., Dayton, Ohio.

EXPERIENCED architect, commissioned officer just released from officers' training school, desires work at $160 per month. Experienced draftsman, specification writer and superintendent. Had own office before war. Married and 26 years old. Harold V. Walsh, 602 South Broadway, Yonkers, N. Y.

POSITION wanted with firm or corporation in need of man for investigation and reports. Wide experience. Personal interview. PW-145, Eng. News-Record, New York City.

POSITION wanted with large structural engineering firm where initiative and ability will be rewarded with responsible charge and commensurate salary. Technical education supplemented by field and office work. PW-77, Eng. News-Record.

WATER-WORKS manager, engineering and construction experience on filtration, paving, sewage and concrete construction. Available Jan. 1. Address W. W. Berry, Accotink, Va.

An Engineer Sales Company

An engineer and experienced contractors machinery salesmen with offices in New York City desires to represent manufacturers of contractors equipment or allied lines, only high-class propositions entertained. We can get results.

AS-110—Engineering News-Record
10th Ave. at 36th St., New York City

MACHINERY SALESMEN

One or two real Equipment Salesmen, preferably familiar with Smith, Insley, Mead-Morrison and Dobbie lines. Must be clean cut men of unquestionable habits, hard workers and business builders. Straight salary proposition. Replies in full detail will be treated confidentially.

BECKWITH MACHINERY CO.
PITTSBURGH, PA.

We handle sell or stock your output here.

CONSUMER BRITAIN WANTS TO BUY

Cranes, Loco's, Steam Shovels

WM. MUIRHEAD & CO. LTD. 4 PARLIAMENT ST. LONDON

Pumps, Pipes, Wagons, Winches

PRODUCER AMERICA WANTS TO SELL

Want put your goods on the British market? Use the Connecting Link

POSITIONS WANTED

TECHNICAL graduate, age 32; resident Chicagoan. Honorable discharge U. S. army; 5 years as district manager and sales engineer for conveying machinery, in Middle West. Capable organizer and executive. Wants responsible connection with high-grade line. Address PW-213, Eng. News-Record, Chicago.

AGENTS AND SALESMEN

Agency for Contractors' Equipment

Attention, Manufacturers—We can sell your mill equipment in New Jersey. We have best connections, through live-wire representatives. Letter will insure interview. Inquiries will be treated confidentially. Room 614, American Mechanic Bldg., Trenton, N. J.

Agencies Wanted

Cleveland branch of large manufacturing and jobbing house has established department for sale of Steam and Power pumps and Steam Specialties and solicits correspondence with manufacturers who can give exclusive territory. AS-93, Eng. News-Record.

Agency for Contractors' Equipment

Do you wish to be represented among the contractors of New Jersey? If they are good, we know them. Write Room 614, American Mechanic Bldg., Trenton, N. J.

Progressive English Firm

Of manufacturing and merchants (well established) with London office open to accept sale rights or agencies for American specialties: electrical, motor or general engineering goods. Write AS-206, Eng. News-Record.

Sales Engineer Now Available

29, graduate, 6 years experience as engineer and salesman, contractors and mining trade in middle west and New York territory. 1st Lt. Engineers, U. S. A. discharged, available now. Salary $2400-$3000. AS-238, Eng. News-Record.

Export & Business Opportunity for Manufacturer

Japanese, American graduated civil engineer, with 7 years' practice in designing and estimating structural steel, masonry, machinery and good knowledge of far east, desires to go back to represent firm where ability is appreciated. Excellent credentials. AS-240, Eng. News-Record.

First Class Salesman Wanted

for contractors machinery and equipment. Reply by letter giving age, experience, references and salary expected. Geo. W. Ziegler Machy. Company, 515 First Avenue, Pittsburgh, Penna.

Austin Trench Machine

For sale, steam power, caterpillar traction, first class condition, can be seen in operation at Stuttgart, Ark. Delivery about Feb. 1. Address E. M. Scheflow, 23 Sherwin Block, Elgin, Ill.

Sales Engineer

Civil engineer (27), 5 years' experience selling, estimating, designing, etc. AS-187, Eng. News-Record.

Contractors Attention!

We have to offer the entire services of an engineering and architectural personnel, who will be released Jan. 1. The organization is able to completely handle the estimating, designing, planning and construction of any kind of an operation. We solicit immediate correspondence before organization is disbanded. AS-177, Eng. News-Record.

Sales Engineer as Representative

In Boston for New England. Must be experienced salesman and in designing reinforced concrete and structural steel. AS-167, Eng. News-Record.

Sales Engineer or District Manager

Qualified for sales promotion. Last position sales promotor with large manufacturing corporation. Extensive experience in the field on heavy engineering construction. Location here or abroad. American, technical graduate. Single. AS-105, Eng. News-Record.

FOR SALE

Complete Modern Portland Cement Plant

Capacity 2000 barrels daily
(Wet Process)

Can be loaded directly on steamer

for shipment overseas.

GIANT PORTLAND CEMENT COMPANY
Pennsylvania Building, Philadelphia, Pa.

Wanted Immediately

Railroad contractor to dismantle a standard gauge railroad located in Pennsylvania. Party must be responsible and with financial standing or will take a good man with experience on percentage basis.

M. K. FRANK
Frick Bldg., Pittsburgh, Pa.

Adding Machines and Foreign Calculating Machines Bought, Sold and Overhauled

W. A. ROTTER
1260 Monadnock Block, Chicago, Ill.
Tel. Harrison 1633

Keep Your Eye on the "Searchlight"

and your advertisements in it

WE HAVE TO OFFER

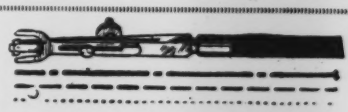
about 5000 yds. weekly of

CLEAN DIRT and GRAVEL also ROCK

This would make good fill. Will deliver anywhere within towing distance of New York Harbor, Newark, Perth Amboy, Staten Island or any other place that can be reached by water.

We will deliver this material at very low prices to anyone interested in same.

ROSOFF ENGINEERING COMPANY
2323 Park Row Bldg., New York, N. Y.
Phone: Barclay 3367



Don't Waste Your Time

Now that the war is over, extensive plans are in progress for reconstruction. These plans will tax the draftsman to his utmost and unless he uses a BERGGREN DRAFTING PEN, much time will be lost. This pen increases efficiency, as well as speed. It draws 30 conventional lines accurately and neatly, without blot or blur. It is not an experiment but in actual use by discriminating draftsmen. Send for our booklet describing the pen.

UNIVERSAL DRAFTING PEN CO., INC.
27 Cannon St., Bridgeport, Conn.
1164 Broadway, New York

Second-Hand Transits and Levels

Guaranteed in Good Order and Adjustment.
Write for New Bargain List.

WILLIAMS, BROWN & EARLE, INC.
918 Chestnut St., Philadelphia, Pa.
Department D

WANTED

Storage Battery Locomotive

Standard Gauge, 15 to 20 tons. Quote price, full specifications and conditions.

National Aniline & Chemical Co., Inc.
Marcus Hook, Pa.

EDUCATIONAL

Teaching or Editorial Work

By former assistant professor of civil engineering. Experience, 6 years' field and office highway, bridge and sanitary engineering; 2 years' editorial work; 2 years' teaching. Assoc. M. Am. Soc. C. E. Recently employed on cantonment construction. C. R. Thomas, 621 Perry Ave., Greenville, S. C.

PATENT ATTORNEYS

PATENTS—Don't lose your rights. Send for blank form "Evidence of Conception," to be sighted and witnessed. Establish your rights in the start. Form and information concerning patents free. Lancaster & Allwine, 272 Ouray Bldg., Washington, D. C.

WANTED

Magazines Wanted

Back numbers of technical, chemical, trade and other standard magazines bought and sold. The H. W. Wilson Co., 958 University Ave., New York, N. Y. Largest magazine dealers in New York.

MISCELLANEOUS

Structural Designing and Detailing

Standard shop practice. Satisfaction guaranteed. Inquiries solicited. Advance Engineering Co., 440 S. Dearborn St., Chicago, Ill.

Shop Details

Structural engineer solicits structural detailing and designing. Location Philadelphia. Reasonable rates. Prompt results. M-186, Eng. News-Record, Philadelphia.

KING & KING
Attorneys-at-Law
728 17th Str., Washington, D. C.
Attention specially given to matters relating to the rights of Government Contractors before the Executive Departments and the Court of Claims.

We Will Buy

All classes of Contractors

Used Machinery Equipment Rails

Etc.

Terms draft attached B/L all shipments

The National Equipment Corp'n.
1322 Widener Bldg., Philadelphia, Pa.

PIPE WANTED
Fifty 3 or 4-foot lengths of 24 in. steel or wrought iron pipe.
THE HAMERSLEY MFG. CO.
Carfield, N. J.

WANTED
CONTRACTORS' EQUIPMENT
of all kinds, for cash—also
PIPE AND FITTINGS
PIPE & CONTRACTORS SUPPLY CO.
3 Dover St., New York, N. Y.

WANTED
2—5 to 10 ton, 4 wheel
LOCOMOTIVE CRANES
Equipped with Magnet.
WARD EQUIPMENT COMPANY
331 Fourth Ave., Pittsburgh, Pa.

WANTED
Second-Hand
CAST IRON PIPE
132 ft. of 18 in., 300 ft. of 12 in., 118 ft. of 10 in., and 108 ft. of 8 in. Write or wire immediately.
LEE T. WARD COMPANY
617-619 Filbert St., Philadelphia, Pa.

LOCKERS

Will buy 100 to 150 metal lockers in good condition. Delivery at New York. Give specifications and prices.

McGRAW-HILL CO., Inc.
10th Ave. at 36th St., New York, N. Y.

WANTED
Two second-hand 500-hp. McNaull
WATER TUBE BOILERS
Must be in good condition.
Advise age of boilers and where same can be inspected and price wanted. Write
THE WALLACE STONE COMPANY
Bay Port, Michigan

WANTED
PIPE MACHINES
2—2½ to 8 or 10 in. and 2—6 to 16 in. motor-driven, 3-phase, 60-cycle. Give full details and lowest price.
W171—Eng. News-Record
1570 Old Colony Bldg., Chicago, Ill.

WANTED
10—5000 to 7500-ton
Cargo Steamers
ready for operation.
Desire to secure possession within next 30 days. Will undertake to secure approval of Shipping Board for transfer of ownership. Would desire to take ones complete with crews. Will also assume completion of uncompleted carrying contracts if attractive. Terms absolutely spot cash, short negotiations. Ample responsibility.

W30—Eng. News-Record
935 Real Estate Trust Bldg.
Philadelphia, Pa.

WANTED
Standard gauge switching
LOCOMOTIVE
saddle tank or sloping tank, short wheel base, cylinders not less than 18 inches in diameter, weight of locomotive not less than 60 tons.
Give full particulars, price and where locomotive can be inspected.
W139—Eng. News-Record
10th Ave. at 36th St., New York City

Keep Your Eye on the Searchlight Section and your Ad in it

FOR RENT

2—12-Ton
ROAD ROLLERS

2—Erie Traction
STEAM SHOVELS

3—Domestic
PUMPS

Several Types
CONCRETE MIXERS

Also considerable other equipment.

For details and information write to

B. R., P. O. BOX 53
Baltimore, Md.

We consider it worth the cost of this advertisement to wish a

Merry Christmas Season

to all who read it.

FREDERICK P. LUTHER CO.

14 E. Jackson Boulevard, Chicago, Ill.

LOCOMOTIVES, CARS, CRANES, DRAGLINES, DREDGES

FOR RENT

NO. 3 BROWNING LOCOMOTIVE CRANE

75-ft. boom, 30-ton capacity.

Bucket operating drums. For terms and conditions, address

The West Park Eng. & Erecting Co.
No. 648 Engineers Bldg., Cleveland, O.

STEAM SHOVEL

FOR SALE OR RENT

Type B Erie Traction, full revolving, ¾ yd. dipper, excellent condition. Due at our New York yard this week.

The Hubbard-Floyd Co., Inc.,
90 West St., New York City
Old South Bldg., Boston, Mass.

An OLD Business Under a NEW Name In Railroad and Industrial Equipment

In the past, I have conducted my equipment business through the office of and in the name of

EDWARD JOBBINS

My experience in this line has convinced me that the interests of my clients can be better served by conducting my business under my own firm name.

Consequently, I have severed all connections with Edward Jobbins.

We are prepared to give careful personal service to all our old clients and we will be pleased to receive their continued patronage.

P. E. FRANCIS & CO.
Marquette Bldg., Chicago, Ill.
Phone Central 6258

FOR RENT

CRANE

Browning 25—30 ton, 8-wheel bucket handling

Available Immediately—No Brokers

F886—Eng. News-Record
935 Real Estate Trust Bldg., Philadelphia, Pa.

FLOATING STEAM DIGGER and DERRICK

TO RENT

BUCKET

1-yd. Clamshell in N. Y. Harbor. Also sand, cinders, dock, rip-rap and one-man stone.

MODEL CONTRACTING CO.
264 W 34th St., New York City

FOR RENT

AUSTIN TRENCHING MACHINE

Style "O." Cut 27, 36 and 42 in. wide and 0 to 16 ft. deep.

WINGO & DEANER
Richmond, Va.

FOR RENT

2—No. 3
KEYSTONE EXCAVATORS

Fully equipped for Grading or Ditching with Expert Operators.

F. D. LEFFINGWELL, Montclair, N. J.

FOR RENT

2—Keystone Grading and Ditching Machines No. 3.

1—Keystone Grading and Ditching Machine No. 6.

2—Marion Steam Shovels, ⅝-yd.

Also one Parsons Trenching Machine, Model F.

All the above furnished with or without operators.

W. PENN CORSON
Camden, N. J.

Back in Harness

With more pep than we ever had.

The call came and we closed up shop to don the Khaki.

Uncle Sam said our work was finished so we are ready with our former organization to take on sales agencies for mechanical equipment.

We will give you a live representation in the East if you have a live product to sell, which requires aggressive, technically trained, practical men to push.

SERVICE EQUIPMENT CO.
Sales Engineers
Office and Display Rooms
Exhibition Floor
Bourse Building, Philadelphia, Pa.

FOR RENT

1—¾-yard. Browning
STEAM SHOVEL
and 1—⅞-yard. Communicate

PECKHAM CONSTRUCTION CO., Inc.
Buffalo, N. Y.

FOR RENT

No. 0 AUSTIN TRENCH MACHINE

in good condition—at present working at Camp Humphries, Va. An exceptional opportunity.

Write—Wire—Phone or Call

JOS. W. SLATER
122 So. Fairfax St., Alexandria, Va.

SOME ONE WANTS TO BUY

the equipment or machinery that you are not using. This may be occupying valuable space, collecting dust, rust and hard knocks in your shops and yards.

SELL IT BEFORE DEPRECIATION SCRAPS IT

THE SEARCHLIGHT SECTION IS HELPING OTHERS

—LET IT HELP YOU ALSO.

Sound Plant in Good Operating Condition For Sale

ROCK DRILLS

100—McKiernan-Terry "Wizard" Rock Drills, 2¼ to 3 in., with tripods for air or steam, all brand new.

LOCOMOTIVES

3— 9 x 14, 13-ton, H. K. Porter, Dinkeys, 36-in. gauge.
1—10 x 16, 18-ton H. K. Porter, Dinkey, 36-in. gauge.
1—10 x 16, 18-ton Vulcan Dinkey, 36-in. gauge.
2—20 x 26, 125-ton Brooks Locomotives, standard gauge.
1—15 x 24-in., 32-ton, 4-wheeled, standard gauge.

BOILERS

3000 ft. 45-lb. Rail.
1—150-hp. R. T. Butt & Strap, with front and fittings, 150 lb. pressure.
3—50-hp. Locomotive type, on skids.
1—20-hp. Vertical type.
2—12-hp. Vertical type.
1—40-hp. Vertical submerged flues.
1—40-hp. Locomotive type, on wheels.

CRUSHERS

2—No. 3 B Gates Gyratory Crushers.
1—No. 6 B Gates Gyratory Crusher.

CARS

14—Standard gauge, 6-yd., Peteler Dump Cars.

COMPRESSORS

2—18 x 18¼ x 24 Ingersoll-Sargeant Steam Driven, straight line.
1—12 x 12 x 16 Duplex, Rand Steam Driven, with receiver.

CONCRETE MIXERS

2—Ransome, 1-yd. on skids, with steam engine, but no boiler.
1600 sq.ft. of Blaw Panel Forms.
1—21-ft. Milwaukee Paver, good as new.

TOOL STEEL

5 tons Black Diamond flat tool steel.

STATIONARY STEAM ENGINES

11—From 1 to 60 hp.

ELECTRICAL MACHINERY

2—10-hp. A.C. Motors, 220 volts, 60 cycle, 3 phase.
1—20-hp. A.C. Motor, 220 volts, 60 cycle, 3 phase.
1—60-kw. Belt Driven Generator (Woods).

PUMPS

15—Force Pumps—from 20 to 600 gals. per min. capacity.
8—Centrifugal from 600 to 12,000 gals. per min. capacity.

HOISTING ENGINES

8—Hoisting Engines, from 5 to 20 hp.

STEAM SHOVELS

15—Steam Shovels—18 to 100-ton, with dippers ¾ to 3½ yd.
24—Steel Skips — extra strong, 3½-yd. capacity.
6—Steel Skips — extra strong, 1½-yd. capacity.

Locomotives, Drills, Pumps, Steam Shovels, Derricks, Etc.

All thoroughly overhauled and ready for immediate and constant service.

UNITED STATES EQUIPMENT CO., 208 S. La Salle St., Chicago

Steel Sheet Piling

200 pcs. 14-in. Lackawanna Arch Web, 40 to 49 ft.
30 pcs. 14-in. Lackawanna Arch Web, 20 to 40 ft.
50 pcs. 14-in. Lackawanna Arch 10 to 20 ft.

Only piling in good drivable condition offered by us.

BROWN & SITES CO.
30 Church St., New York City, N. Y.

FOR SALE

S. H. black wrought iron plates, good as new, about

30 ton of 12 gauge, 6 ft. x 2 ft. 8 in.
35 ton of 9 gauge, 6 ft. x 2 ft. 8 in.
12 ton of 12 gauge, 4 ft. x 2 ft.
15 ton of 11 gauge, 4 ft. x 2 ft.
•20 ton of 12 gauge, 30 in. x 70 in.
•10 ton of 14 gauge, 30 in. x 55 in.
•10 ton of 15 gauge, 64 in. x 32 in.
•20 ton of 10 gauge, 6 ft. x 2 ft.

•These plates are cut from the tops.

Will do for tanks or coal chutes. Plates cut in section 24 ft. x 8 ft. and 30 ft. x 10 ft.

TRI-STATE PIPE COMPANY
Bellaire, Ohio

FOR SALE

CONCRETE EQUIPMENT

1—No. 110 Smith Mixer, with 8 x 12 Engine.
1—1 cu.yd. Insley Floor Hopper, with fit- sheaves.
1—cu.yd. Insley Floor Hopper, with fittings.
1—75 ft. 14 in. Insley Concrete Chute, with fittings.
1—Double Cage Elevator, complete with sheaves.
1—4¾ x 6 D.C. S.D. American Hoist, 10 hp., Reversible.

F. WILLIAM STOCKER, INC.
Hoboken, N. J.
Phone Hoboken 2274

MACHINERY FOR SALE

BULL RIVETER

1—W. H. Wood Hydraulic Riveter, complete with accumulator, high pressure pump, container, and hydraulic hoist. Riveter has 8 ft. 3 in. gap.

BENDING ROLLS

1—Set 10 ft. 6 in. Power bending rolls with reversing mechanism, hand raising and lowering attachments. Top roll 12 in. diameter, bottom rolls 8 in. diameter double pulley drive.

RADIAL DRILL

1—American 42 in. Arm, 36 in. swing cone drive, worm movement. Swinging and tilting table.

HORIZONTAL PUNCH

1—10-in. throat, machine capacity ¾ in. through ¾ in.

COMBINATION PUNCH AND SHEAR

1—No. 4 Long & Allstatter—5 in. throat.

F. MAYER, 1601 Monadnock Bldg., Chicago, Ill.

Reconstruction! Re-equipping! Resuming!

Will ***you*** be one of those who were ***not*** ready?

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RAILS! IMMEDIATE SHIPMENT

3000 tons 70-lb. Relaying Rails, guaranteed to pass Hunt's inspection. Chicago delivery.

Wire or Write for price, etc.

THOS. J. DOLAN
76 W. Monroe St., Chicago, Ill.

A FEW BARGAINS READY TO SHIP

1—American **Locomotive Crane**, 10 ton, 4 wheel, single line, 47 ft. boom.
1—Browning **Locomotive Crane**, 15 ton, 4 wheel, equipped for bucket, 42 ft. boom.
1—Thew **Steam Shovel**, No. 0, traction. Shop No. 960. ⅝ yd.
1—Thew **Steam Shovel**, Type A-1, traction, ¾ yd., standard boom and dipper, also long dipper stick for sewer work.
250 tons Lackawanna **Sheet Piling**, 14 in. arch webbed, 21 ft. long, like new.
1—Keystone **Shovel** No. 3, with skimmer scoop, on traction wheels.

Moore Bros REBUILT MACHINERY

39 S. La Salle St., Chicago, Ill.

For Sale or Rent

The Following Thoroughly
REPAIRED EQUIPMENT

LOCOMOTIVE CRANE

7½-ton Industrial, 4-wheel, 30-ft boom, bucket operating.

STEAM SHOVELS

1—Marion 75, 4-yd. dipper, shop number 2191.
1—Bucyrus 70-C, 2½-yd. dipper, shop number 1712.
1—Marion 60, 2½-yd. dipper, shop number 1999.
1—Bucyrus 35-B, 1½ and 1¼-yd. dippers, shop number 1837, full revolving, caterpillar traction.
1—Erie Type B, ¾-yd. dipper, shop No. 389, long boom.
1—Marion 70, 2½-yd. dipper, shop No. 2693.
1—Marion 28 full revolving, traction wheels, ¾-yd. dipper, shop number 2803

LOCOMOTIVES

8—18-ton, 10 x 16-in., 4-wheel Dinkeys, 36-in. gage
4—15-ton, 9 x 14-in., 4-wheel Dinkeys, 36-in. gage.
2—10-ton, 7 x 12-in., 4-wheel Dinkeys, 36-in. gage.

SPREADERS

1—Western Hand Spreader, standard gage.
1—Western Hand Spreader, narrow gage.

CARS

20—12-yd. Western air dump, standard gage.
100— 4-yd. Western Steel Beam, 36-in. gage.
75— 4-yd. Western Wood Beam, 36-in. gage.
13— 4-yd. Oliver Wood Beam, 36-in. gage.

HOISTS

3—Byers 2-drum, 6 x 8, with boilers.
1—Lidgerwood, 9 x 10 skeleton Cableway, 2-drum.
1—Lidgerwood, 2-drum, 7 x 10, with boiler.
1—Lidgerwood, 3-drum, 7 x 10.

COMPRESSOR

1—Ingersoll-Rand, 12½ x 12, belt-driven Compressor, complete with receiver, 300-ft. capacity.

PUMPS

1—Novo Centrifugal Pump, 4-in. suction, 4-in discharge, 6-hp., shop number 24745.
1—F-M Centrifugal Pump, size 5, 5-in. suction, 5-in. discharge, shop number 24864.
2—Emerson No. 2 Pumps.
3—Emerson No. 3 Pumps.
2—Emerson No. 4 Pumps.

RAIL

20 tons 40-lb. Relaying Rail.
200 tons 70-lb. Relaying Rail.

MISCELLANEOUS

1—No. 2 Union Steam Hammer.
1—No. 7 McKiernan-Terry Steam Hammer.
1—No. 1 McKiernan-Terry Steam Hammer.

CABLEWAY

1—Lidgerwood Cableway, complete except towers, 9 x 10 engine, 1164-ft. span, 3-ton capacity.

CLAM SHELL BUCKETS

1—¾-yd. Owen, new, with teeth.
2—½-yd. Owen.

Offer Us Your Used Equipment

We are always in the market for heavy construction equipment and buy for cash. We have large repair shops in Pittsburgh, where all equipment is thoroughly repaired before being re-shipped.

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H. KLEINHANS CO., Union Arcade, Pittsburgh, Pa.

Eastern Office: 30 Church St., New York

KLEINHANS

NOW READY FOR IMMEDIATE SHIPMENT

LOCOMOTIVE CRANES

2—O. & S. NEW 30 ton, 8 wheel M. C. B. equipped, 75 ft. booms and 2 yard clamshell buckets.

1—Browning, Type No. 1, 15-ton, 4-wheel crane 45-ft. boom, bucket drums equipped, 1-yd. clamshell.

1—"American" Railroad Ditcher. "Twenty Machines in One" Locomotive Crane Work, Clamshell and Orange Peel Bucket Work, shipbuilding, log loading, steam shovel work, etc.

1—Byers Auto Crane, equipped with 30-ft. boom and ¾-yd. clamshell bucket.

LOCOMOTIVES

1—60-ton American 6-wheel switcher, driving wheels, 44-in. diameter, carries 150-lb. steam, no truck weight, all on drivers. Excellent condition, just out of shop.

1—60-ton Mogul, 18 x 24, 6 drivers, 4-ft. diameter, 3½ in. tires.

1—Baldwin, 30-ton standard gage, type 0-4-0, saddle tank.

AIR COMPRESSOR

1—Sullivan straight line, 2-stage, Class WB-2, capacity 1160 ft., 100-lb. pressure, speed 110 r.p.m.

BUCKETS

1—¾-yd. capacity Orange Peel Bucket.
1—1-yd. Clamshell Bucket.
2—1½-yd. single line clamshell Buckets.

BOILERS

1—Marine type, 150-hp. (portable).

1—Marine type, 100-hp. Freeman internal fired, portable boiler, diameter 84 in., length overall 18 ft. 125-lb. pressure.

1—30-hp. locomotive type, portable Boiler and engine, mounted on iron wheels with engine mounted on top of boiler.

GENERATOR

1—100-kw. Western Elec., 125-volt, D.C., belted to Ball Engine.

MINE HOISTS

Lambert 10½ x 12 double cylinder, single drum, 38-in. diam., 24-in. face. Drum grooved, will take up ¾-in. cable. Drum flanges 8 in. deep. Link motion.

1—Flory, 8½ x 10, D.C., D.D., skeleton, link motion, has quadrant.

REVOLVING SHOVEL

1—Marion Model 28, on traction wheels, ¾-yd. dipper, Shop No. 3832, new in Spring, 1917. Like new in condition.

DERRICK HOISTS

1—60-hp. Puget Sound, heavy duty, double cylinder, double drum Hoist, with 60-in. diam. butt strapped boilers. Good log loader or heavy derrick engine.

2—Byers 16-hp. double cylinders, double drum, equipped with boilers and swinging gears.

1—9 x 10 Lidgerwood, double cylinder, double drum, with special boiler, all steel gears, engine built for heavy duty.

1—9 x 10 D.C., D.D., heavy duty Lidgerwood, with Boiler; steel gearing throughout.

CABLEWAY ENGINE

1—Flory 10 x 12 D.C. double tandem drum engine. Drums 40 in. diam. x 40 in. face. Levers banked in quadrant.

CONCRETE MIXERS

1—Standard 10-cu.ft., gasoline driven, mounted on trucks, complete with loading platform.

1—No. 4 Smith, with steam engine on skids.

1—Lot concrete spouting, size 14½-in. wide, 9½-in. deep; hopper connection.

CARS

6—Flat Cars, 50,000 lb. capacity, M.C.B. journals 4 x 7.

4—1-yd. capacity "V" shaped steel two-way dump, 30-in. gage.

F. MAYER, 1601 Monadnock Building, Chicago, Ill.

FOR SALE

EQUIPMENT

Locomotive, 8 wheel, 35 ton, standard gauge
Locomotive, 7 x 12 Vulcan, saddle tank, standard gauge
Bell, 7 ton, oil, standard gauge
Air Compressor, Laidlaw-Dunn-Gordon, 16 x 12, belt driven
2—Holt Caterpillar **Tractors** (45 and 60)
Mundy Hoist, 6 x 12, D.D., D.C.
Kelly-Springfield, 3 wheel, 10 ton **Roller**
Port Huron, 3 wheel, 10 ton
Kelly-Springfield Tandem, 6 ton
Foote Mixers (6A and 5A)
Drag Line, 50 ft. steel boom
Koppel Track, 24 in. gauge, switches, cars, locomotive
Shovel, Marion No. 18, full revolving, ¾ yd.
Climax 36 in. **Locomotive**, 13 ton
18—**Steel Cars**, end dump, 36 in. gauge
20—Watson Bottom **Dump Wagons**

D. B. STRALEY
Crown Point, Ind.

CRAVEN'S EQUIPMENT LIST

Air Compressors, Asphalt Plants, Boilers, Buckets, Cars, Concrete Mixers, Crushers, Derricks, Engines, Excavators, Heaters, Hoists, Locomotives, LOCOMOTIVE CRANES for sale or rent, Pipe, Pumps, Steam Rollers, Steam Shovels, Tanks.

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Guaranteed in Good Working Condition

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TANKS

6300 gallon and smaller No. 8 gauge steel storage "in stock." Black and Galvanized Pneumatic and gasoline tanks, drums, etc.

Wood Tanks, all descriptions
Write for Prices

NATIONAL PRODUCTS CO.
East Liverpool, Ohio

FOR SALE OR RENT

Owned by Us and Sold Under Absolute Guarantee

STEAM SHOVELS

1—95-C Bucyrus, shop No. 1304.
4—70-C Bucyrus, shop Nos. 1552, 1287, 1126, 2½-yd. dippers.
1—Standard 70-ton Bucyrus, shop No. 733, 2½-yd. dipper.
1—45-C Bucyrus, shop No. 1202, 1½-yd. dipper.

REVOLVING TRACTION SHOVELS

1—Bucyrus 18-B Revolving Traction Shovel, ¾-yd. dipper, Shop No. 2005, for rent only.
1—Model 28 Marion, ¾-yd. dipper, shop No. 2988. Has moved 80,000 yd. Good as new. Immediate shipment.
1—0 Thew traction shovel, shop No. 1002, ¾-yd. dipper.

DUMP CARS

30—12-yd. standard gage Western air dump cars
12—12-yd. standard gage Oliver side dump cars
20—16-yd. standard gage Western Side Dump Cars.
5—6-yd. standard gage K. & J. side dump cars.
25—4-yd., 36-in. gage Western.
20—2-yd., 24-in. gage Western Dump Cars, as good as new.
40—1½-yd., 24-in. gage Western Dump Cars

LOCOMOTIVES

1—18 x 24 cylinder, 10-wheel locomotive, weighing 55 ton, with 42 ton on drivers; built by American Locomotive Co., in 1907; steam pressure, 170 lb. rigid wheel base, 10 ft. 2 in.; wheel centers, 44 in. in diameter. Most modern locomotive, receiving general overhauling. Suitable for switching, if desired.

1—Standard gage, 10 x 16 Porter saddle tank locomotive, weight 19 ton; steam brakes, automatic couplers, 160-lb. steam pressure. Locomotive built in 1910.

1—10 x 16 Standard gauge Porter saddle tank Locomotive, 0-4-2 type; weight 21 tons, steam pressure 160 lb.; Westinghouse air brakes and automatic couplers

10—36-in. gage, 10 x 16 and 9 x 14 Davenport Vulcan and American saddle tank locomotives.

1—7 x 12 cylinder, 24-in. gage Davenport, saddle tank locomotive. Weight 9 tons.

DRAG LINES

1—Class 14 Bucyrus Dragline, on skids and rollers, 60-ft. boom, 2-yd. bucket.

1—Class 24 Bucyrus, steam operated, all steel dragline, 100-ft. boom, 3½-yd. Page bucket, mounted on skids and rollers.

1—No. 2 Monighan steam operated all-steel dragline, 60-ft. boom; 1½-yd. Page bucket; mounted on skids and rollers.

1—No. 1 Monighan Dragline Excavator mounted on most improved walking device; equipped with 40 ft. boom and 1-yd. Page bucket 45 H.P. 3-cylinder Westman Engine; Delco Electric Lighting Plant. Dragline bought new in 1917. Condition good as new.

RAIL, SWITCHES, SPIKES, ETC.

1 miles of track, 45-lb. rail, with angle bars.
1 mile of track, 56-lb. rail, with angle bars.
1—Carload 4½, 5 and 5½-in. spikes.
10 tons angle bars for 70-lb. and 75-lb. rail.
10 tons 20-lb. rail with splices.

DITCHING MACHINE

1—No. 5 Buckeye Ditcher equipped with 4-cylinder gasoline engine; 7½ in. x 9 in. cylinders. Machine uses either gasoline or kerosene. Built new in 1917. Condition as good as new.

BOILERS, COMPRESSORS, ETC.

3—Brownell, 72-in. x 18-ft. Horizontal Tubular Boilers, with 4-in. tubes.
1—20 x 22½ x 15½ x 21 AA1 Ingersoll-Rand Compressor.
1—66 x 18 vertical air receiver, complete.
1—30 x 6 vertical air receiver, complete.
1—16 x 16 x 18-in. Laidlaw-Dunn-Gordon Air Compressor with reservoir, weight 15,000 lb.
1—Stationary Engine, horisontal center crank type, 10 x 12-in. cylinder, slide valve type, 25 hp.

CLAPP, NORSTROM & RILEY EQUIPMENT CO.

12 and 14 South Canal St., Chicago **Northwestern Branch: 1308 Pioneer Bldg., St. Paul, Minn.**

Bargain Prices—Prompt Shipment—Wickes Quality

REFITTED MACHINERY

Money-Back Guarantee

BOILERS

1—400-hp. Wickes Water Tube, 150-lb.
2—300-hp. Wickes Water Tube, 150 lb.
2—72-in. x 18-ft. HRT, 150-hp., 125-lb.
2—66-in. x 16-ft. HRT, 100-hp., 125-lb.
1—74-in. x 25-ft. Manning Vert., 200-hp., 125-lb.
1—84-in. x 16-ft. Marine Portable, 100-hp.
1—15-hp. Ames, with engine on top.
100 other Boilers.

SMOKE STACKS

1—72-in. dia., 82-ft. high.
11—26-in. dia., 90-ft. high.

ENGINES

22 x 42 Allis-Chal. Corliss, 325-hp.
16 x 36 Murray Corliss, 150-hp.
14 x 30 Watts-Camp. Corliss, 100-hp.
12 x 30 Nagle Corliss, 80-hp.
10 x 24 Harris Corliss, 50-hp.
20 x 18 Watertown, 4-valve, 300-hp.
14 and 28 x 24 Buckeye Cross Compound, 300-hp.
16 x 14 Ames Automatic, 200-hp.
13 x 16 Chandler & Taylor Auto., 125-hp.
11 x 11 Ball & Wood Auto., 100-hp.
10 x 12 Erie Automatic, 70-hp.
16 x 16 Noye Throttling, 100-hp.
14 x 16 Nagle Throttling, 80-hp.
12 x 16 Erie Throttling, 60-hp.
10 x 12 Erie Throttling, 40-hp.
40-hp., 5-cylinder, N. Y. Safety Gasoline Engine.
3—Dake No. 3½, 7-hp. Rotary Reversible Engines.
14 x 14 Nagle Vertical, 70-hp.
12 x 14 O & S Vertical, 60-hp.
9 x 9 Nagle Vertical, 30-hp.
75-hp. De Laval Steam Turbine with reduction gears
200 other Engines.

HOISTS

9½ x 12 Lambert, D.C., S.D. link reversing cableway engine, with friction spools and winch head.
7 x 10 Haiss, D.C., D.D. Coal Hoist.
7 x 10 American, D.C., S.D.
6 x 12 Parker, D.C., D.D., with boiler.
6 x 12 Kendall, D.C., S.D., with boiler.
14 x 18 Lidgerwood, D.C., S.D., second motion reversing mine Hoist.
60-hp., 220-volt, dir. cur., D.D. and swinger.
40-hp. Lambert, 220-volt, dir. cur., D.D.
35-hp. Kendall, 500-volt, dir. cur., D.D.
21-hp. Lidgerwood, 550-volt, dir. cur., D.D.

PUMPS

	G.P.M.
16 & 25 x 15 x 15 Worthington Comp. Du.	1800
14 & 20 x 12 x 15 Worthington Comp. Du.	1150
12 & 17 x 11 x 15 Worthington Comp. Du.	963
10 & 16 x 10 x 10 Worthington Comp. Du.	753
9 & 14 x 8½ x 15 Worthington Pot Valve	565
20 x 12 x 15 Worthington Pot Valve Du.	1170
18 x 5½ x 18 Knowles Pot Valve Du.	366
18 x 9½ x 12 Buffalo Duplex	900
17 x 12 x 15 Worthington Duplex	1170
16 x 10 x 10 Worthington Duplex	750
14 x 10 x 10 Worthington Duplex	750
16 x 10 x 16 American Single	400
14½ & 24 x 5½ x 18 Knowles Comp. Single	100
14 x 8 x 14 Epping-Carp. Pot Valve, single	260
14 x 14 x 10 Blake Duplex	1415
12 x 14 x 12 Smith-Vaile Duplex	2000
10 x 14 x 10 Worthington Duplex	1660
10 x 14 x 18 Warren Single	800
12-in. Worthington Centrifugal	4000
10-in. Morris Sand Pump	3000
4-in. Morris Centrifugal with engine	400
24 x 12 x 16 Cameron sinking	587
No. 6 Pulsometer sinking	300
12 x 14 Gould Triplex	1530
8½ x 12 Deane Triplex	700
16 x 9 x 12 Knowles Underwriters	750

500 other Pumps.

ROTATIVE VACUUM PUMPS

8 x 18 x 12 Wheeler wet.
8 x 18 x 18 x 14 Alberger, 2-stage Corliss, dry.

FEED WATER HEATERS

6000-hp. National.
4000-hp. Cochrane
2500-hp. Goubert.
1200-hp. Berryman.
750-hp. National.
50 other Heaters.

MOTORS

200-hp. General Electric, 220/440-volt.
75 other A.C. Motors.
40-hp. C & C 220-volt, D.C.
25-hp. Sprague, 220-volt, D.C.
15-hp. General Electric, 220-volt, D.C.
10-hp. General Electric, 220-volt, D.C.
100-hp. General Electric, 110-volt, D.C.
80-hp. General Electric, 110-volt, D.C.
55-hp. General Electric, 110-volt, D.C.
30-hp. Rushmore, 110-volt, D.C.
20-hp. Westinghouse, 110-volt, D.C.
15-hp. C & C, 500-volt, D.C.
15-hp. General Electric, 500-volt, D.C.
85 other D.C. Motors.

GENERATORS

100-kw. Gen. Elec., 125-volt Ames engine.
75-kw. Gen. Elec., 125-volt, belted.
60-kw. Bullock, 125-volt Ames engine
60-kw. Westinghouse, 125-volt, belted.
50-kw. Westinghouse, 125-volt Ideal engine.
50-kw. C & C, 250-volt Payne engine.
45 other Generators, all sizes.

COMPRESSORS

20 x 20 x 30 Rand duplex steam, 2000-ft.
12 x 19 x 14 x 18 Smith-Vaile, duplex compound, 750-ft.
12 x 18½ x 12½ x 12 Ingersoll, 2-stage, 526-ft.
12 x 12 x 12 Platt Straight Line Steam, 235 ft.
18 x 15 Ingersoll-Rand, duplex belted, 1600 ft.
40 other Compressors.

CRUSHERS

No. 5 Austin Gyratory.
No. 3 Gates Gyratory.
10½ x 22-in. Climax Jaw Crusher.

HEATERS AND BLOWERS

16—Pipe Coils containing 23,400 ft. 1-in. pipe.
12-ft. Sturtevant Blower, with engine.
8-ft. Buffalo Blower, with engine.
78-in. Sturtevant Monogram Blower.
55-in. Buffalo Cupola Blower.
1600-cu ft. Sirocco Double Blower, with 75-hp. steam turbine.
84-in. Sturtevant Exhauster, with 3-hp., 220-volt, D.C. motor.
50 other Blowers and Fans.

MACHINE TOOLS

24-in. x 31-ft. Sellers Lathe.
18-in. x 15-ft. Blaisdell Lathe.
16-in. x 6-ft. Reed Lathe, taper attachment.
2 x 24-in. Jones & Lamson Turret Lathe.
24-in. Barnes Drill, sliding head, B.G.
28-in. Snyder, S.H., B.G.
24-in. Foote-Burte Heavy Drill.
40-in. Bickford Radial, tapping attachment.
30-in. W. E. Gange Co. Plain Radial.
Newton 6-in. Cold Saw.
650-lb. Knoxville Steam Hammer.
600-lb. Lane Steam Drop Hammer.
30 x 30 x 8-ft. Whitcomb Planer.
26 x 26 x 6-ft. New Haven Planer.
21 x 96 Landis Universal Grinder.
4-in. Cox Pipe Machine.
6-in. Curtis Power Pipe Machine.
28-in. x 6½-ft. Newton Slab Miller.
No. 4. Brown & Sharpe Plain Miller.
No. 2 Brown & Sharpe Universal Miller.
Bement Horizontal Boring Mill, 2½-in. bar.
24-in. Hendey Shaper.
7-in. Alligator Shear.
10-ft. Hilles & Jones Plate Pending Rolls.
6-ft. Wickes Plate Bending Rolls.
Watson-Stillman Hydraulic Rail Bender.
3-ton geared Foundry Ladle.
No. 2 Brown & Sharpe Annealing Furnace.

TANKS

2—36-in. x 21-ft. pressure.
4—36-in. x 18-ft. pressure.
2—6 x 31-ft. new, closed storage.
5 x 30-ft. closed storage.
5 x 16-ft. closed storage.
4—66-in. x 9-ft. enamel lined, new.
42-in. x 26-ft. closed storage.
5—18 x 9-ft. 9-in. x 4-ft. open storage.
10 x 14-ft. 9-in. high open storage.

MISCELLANEOUS

26-in. Centrifugal Dryer.
6 x 6-ft. Steam Jacketed Kettle.
36 x 33-in. Jacketed Nitrating Kettle.
United States five-mould Brick Press.
New 21-ft. Exeter Concrete Mixer, steam power on wheels.
No. 4 Ransome Batch Concrete Mixer.
6—2½-yd. Lockwood bottom dump Concrete Buckets.
3—1½-yd. side dump 30-in. gage Cars.

We buy and sell single machines and complete plants

Send for Our Complete List

WICKES MACHINERY CO., Jersey City, N. J.

COMPRESSORS

	Price
1—Rand Imperial, duplex, steam, 2-stage, air 1500 ft. per min.	$3000
1—8½ x 9 Westinghouse, almost new	150
1—Sullivan, 2 stage air, simple steam, capacity 1800 ft. at 80 to 100 lb.	2500
1—14 x 16 x 10 x 16 Sullivan, 2 stage air, simple steam, capacity 600 ft. at 80 to 100 lb.	1500
1—Ingersoll-Rand, belt driven, 2-stage, 500 ft.	1750
1—Sullivan 2 stage, belt driven, 1400 ft., good as new, f.o.b. St. Louis	4500
1—Norwalk, 2 stage air, simple steam, cap. 427 ft.	1200

DERRICKS

1—Stiff Leg, mast 24 ft., boom 46 ft., 12 ft. bull wheel, timbers 12 x 12	$450
1—Stiff Leg Hand Derrick, mast 18 ft, boom 22 ft., 6 x 6 timbers	200

CARS

3—50,000 capacity, 34 ft. 8 in. long, flat cars, each	$400
20—12 yd. Western Air Dump, each	1100

CRUSHERS

1—Gates D. No. 8 Right Angle Drive,	$4500
1—Austin, No. 5 Direct Drive	1500
2—Austin, No. 7½ Direct Drive, each	2500
2—Jaw Crushers, 18 x 36 in., each	2000
1—Jaw Crusher, Universal, 8 x 12, new	300
1—Jaw Crusher, Blake, 10 x 20	750
1—Gates D. No. 7½, plant complete. Write for prices.	
1—No. 9 Gates K	$6500
1—No. 12 Gates K	11000

ELEVATOR AND SCREENS

1—No. 9 with 36 in. buckets, good condition, without belt	$900
1—Stephens & Adamson stone screen, 42 in. x 16 ft., with dust jacket, practically new	700
1—48 x 18 Austin screen with dust jacket	800
1—40 x 18 Gates screen with dust jacket	700
1—40 x 18 Gates screen, with dust jacket	900
6—Stephens-Adamson screens, ea.	150

STEAM ROLLER

	Price
Aveling & Porter 12 ton	$925

BUCKETS

3—Brown Hoist, 2 yd. Clamshell, each	$550
1—McMyler Power Bucket Clamshell	500
1—Hayward, 1½ yd. Clamshell	550

CRANES

1—Erie, with 32 ft. crane boom and ¾ yd. clamshell	$12,000
1—10 ton McMyler, 4 wheel, with ¾ yd. Clamshell	8250

HOISTS

1—7 x 12, D.C., D.D., Mundy, with Butt strap boiler, new gears and frictions	$1200
1—6¼ x 10, D.C., D.D., American, without boiler	575
1—6¼ x 10, American, with boiler	900
1—6 x 10, Extra 3 drum Skeleton, almost new	600
1—6 x 8, S.C., S.D., Contractors' Skeleton	250
1—12 x 14 D.C., D.D., Special Dragline Engine, new	2000
1—9 x 10 Lidgerwood 3-drum link motion	1750

DINKEY LOCOMOTIVES

1—Porter standard gauge 9 x 18 saddle tank boiler, only two years old and in good condition	$2500
1—Vulcan, 36 in. gauge, 9 x 14 saddle tank steel cab	1250

PUMPS

1—12 in. Morris, sand, belt drive	$600
1—10 in. Morris, sand, belt drive	500
1—8 in. Morris, water, belt drive	300
1—20 x 10 x 14 Worthington duplex	600
1—Wilson-Snyder water works pump, complete with condenser	2000

DRAGLINE

1—No. 3 Monighan 65 ft. boom, 3 yd. bucket, fine condition	$13,000
1—Class C, Lidgerwood, 60 ft. boom, 1½ yd.	15,000

STEAM SHOVELS

	Price
1—28 Marion Traction, ⅝ yd. dipper	$4800
1—No. 1 Thew Traction, 1¼ yd., perfect condition	5500
1—No. 0 Thew Traction with ⅝ yd. dipper, fine condition	4000
1—45 ton Bucyrus, standard gauge, 1¾ yd. dipper	6500
1—70 ton Bucyrus with 2½ yd. dipper	7000
1—Model 60 Marion with 2½ yd. dipper	6250
1—Model 45, Osgood, 1½ yd. almost new	7500
1—70 C. Bucyrus, with high boom, extra dipper stick, also standard equipment	11,500

CABLEWAY

1—9 x 10 Lidgerwood, 3 drum engine and boiler and carriage and part of other fittings, no rope	$3000

BOILERS

2—Erie City Economic, 60 hp. each	$850
1—Upright, 66 in. x 11 ft. 6 in.	750
1—Upright, 30 in. x 7 ft.	250
1—Upright, 9 ft. 6 in. x 52 in., Butt strap	850
1—Upright, 9 ft. x 42 in.	350
1—200 hp. Marine type	2200

ENGINES

1—Tandem 12 x 15 Dragline Engine	$1750
1—Sturtevant 5 x 5, 400 r.p.m.	150
1—Erie City Horizontal, 8 x 10	150
1—Corliss 16 x 36, right drive, heavy duty, Allis Chalmers	1500
1—Westinghouse, self-contained, 10 x 16, D.C.	200
1—Atlas Horizontal, 14 x 20	650
1—Erie City, 60 hp., 11 x 15, center crank	200
1—Keystone, 7 x 10, Reversible	150

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LOCOMOTIVE CRANES

1—20-ton Link Belt, 8-wheel, M.C.B., 50-ft. boom, 1¼-yd. Clam Shell Bucket.
1—7-ton Erie, 32-ft. boom, bucket operating.
1—20-ton Browning, 8-wheel, M.C.B., 50-ft. boom, 1½-yd. Clam Shell Bucket.
1—30-ton O. & S., 8-wheel, M.C.B., 65-ft. boom, with 2-yd. Hayward Clam Shell.
1—15-ton Browning, 8-wheel, M.C.B., 50-ft. boom, bucket operating.
1—25-ton American, 8-wheel, M.C.B., bucket operating, 50-ft. boom, magnet and generator.
1—20-ton Brown Hoist, 8-wheel, M.C.B., 50-ft. boom, equipped with magnet and generator.

STEAM SHOVELS

1—¾-yd. Thew, gasoline operating.
2—No. 0 Thews.
1—Marion, Model G.
1—45-ton Bucyrus, equipped with 1¼-yd. dipper.
1—75-ton Bucyrus.
2—¾-yd. No. 0 Thews.

LOCOMOTIVES

1—18-ton Davenport, 36-in. gage.
1—Baldwin 060 Switcher, standard gage.
1—Baldwin Passenger Type, standard gage.
1—14-ton Porter, 24-in. gage.
2—20-ton Vulcans, 36-in. gage.

CARS

4—50,000-lb. capacity Flat Cars, standard gage.
2—80,000-lb. capacity Gondola Cars, standard
15—4-yd. Western Dump Cars, 36-in. gage.
12—1-yd. Koppel Cars, 24-in. gage.
4—¼-yd Koppel Cars, 24-in gage.

BUCKETS

1—1 -yd. Owen Clam Shell Bucket.
2—1½-yd. Hayward Clam Shell Buckets.
1—¾-yd. Hayward Clam Shell Bucket.

BOILERS

1— 50-hp. Locomotive type Boiler.
1—100-hp. Clyde Vertical Boiler.
2—200-hp. Clyde Vertical Boilers.
2—250-hp. Gary type Boilers.

HOISTS

1—7 x 10, 3-drum American, with boiler.
2—7 x 10 Americans, D.D., reversible.
1—American Electric Hoist, D.D., with swinger, 30-hp. Wagner motor.
1—8½ x 10 Flory with boiler.

EXCAVATORS

1—Lidgerwood Class "B" Excavator, revolving type, D.D., D.C. engine, 60-ft. boom, Page 1½-yd. bucket.
1—Lidgerwood Drag Line Excavator, 60-ft. boom, equipped with 1½-yd. Page bucket.

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1—No. 3 Type "B" Jaw Crusher, Allis-Chalmers.
1—No. 5 Austin Crusher.
1—Farrell Jaw Crusher, 12 x 15, mounted on steel trucks.
1—Wheeling Mould & Fdy. Co. Jaw Crusher, 10 x 18, on skids.
1—No. 5 Gates Gyratory Crusher.

PHILADELPHIA STOCK

LOCOMOTIVE CRANES

1—20-ton Industrial, 8-wheel, M.C.B., bucket operating, 50-ft boom.
1—10-ton Browning, 4-wheel, bucket operating, 35-ft. boom.
2—7-ton Eries, 32-ft. booms, 4-wheel, bucket operating.

STEAM SHOVELS

1—¾ Erie.
1—No. 0 Thew.
1—No. 3 Thew.
1—70-C Bucyrus.
1—60-ton Marion.
1—Marion, Model 31, equipped with dipper and 80-ft. Browning boom.

LOCOMOTIVES

1—Vulcan, 14-ton, 36-in. gage.
1—Porter, 18-ton, 36-in. gage.
1—Baldwin, 38-ton switcher, cylinders 19 x 24.
1—Baldwin, 10-wheel, cylinders 9 x 24.

CARS

6—¾-yd., 2-way side Dump Cars, 24-in. gage.
1—70,000 capacity Gondola Car.
2—Flat bottom, side dump Cars.
24—1½-yd., 2-way, side dump Cars.
8—60,000-lb. capacity Flat Cars.

BUCKETS

1—½-yd. Haiss Clam Shell Bucket.
2—Bottom Dump Buckets, 1-yd.
2—1-yd. Tipple Buckets.
85—1½-yd. Stuebner Turnover Buckets, 36-in. gage.
1—Hayward Orange Peel Bucket, 1-yd.
2—Hayward Clam Shell Buckets, 2-yd.

BOILERS

1— 35-hp. Browning Upright Boiler.
1— 20-hp. Upright Boiler.
2— 60-hp. Locomotive Type Boilers.
2— 30-hp. Lidgerwood Upright Boilers.
1—125-hp. Locomotive Type Boiler.
1—150-hp. Return Tubular Boiler.

DERRICKS

1—Stiff-leg Derrick, 50-ft. boom and bull wheel.
2—Stiff-leg Derricks, 62-ft. booms and bull wheels.
1—50-ft. Derrick Car, complete with 30-hp. Lidgerwood and 1-yd. Clam Shell Bucket.

HOISTS

1—7 x 10, D.D., D.C. Lidgerwood with boiler.
1—8½ x 10, 3-drum Stroudsburg, with boiler and swinger.
2—8½ x 10 Mundys.
1—Novo 10-hp. Reversible Hoisting Engine, S.D.
1—D.D. Lambert, without boiler.

Miscellaneous Tanks, Road Rollers, Cable, Pumps, Hammers, Crushers, Motors, etc.

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2—American Stiff-Le Derricks, 50-ft. masts, 40-ft. booms.
1—American Guy Derrick.
1—All-steel Travelling Derrick, 40-ft. boom, complete with 3-drum, 8 x 12 Mundy Hoisting Engine and 1-yd. Williams Clam Shell Bucket.

PITTSBURGH STOCK

LOCOMOTIVE CRANES

1—20-ton Browning, 40-ft. boom, 8-wheel, M.C.B., bucket operating.
1—15-ton Browning, 42-ft. boom, 8-wheel, M.C.B. bucket operating.
2—40-ton Industrials, 60-ft. boom, 8-wheel, M.C.B. bucket operating.
1—30-ton O. & S., 75-ft. boom, 8-wheel, M.C.B., bucket operating.

STEAM SHOVELS

1—Marion No. 250, 75-ft. boom, 3½-yd. dipper.
1—80-ton Traction Steam Shovel, 1-yd. dipper.
1—65-ton Vulcan Steam Shovel.
1—Type O Thews.

LOCOMOTIVES

1—50-ton Mogul type Baldwin, cylinders 18 x 24.
1—25-ton Baldwin, 3-drivers, saddle tank, 36-in. gage.
1—20-ton Vulcan, 36-in. gage.
2—40-ton Baldwins, 4-wheel, cylinders 17 x 24.
1—Rock Island, type 460, standard gage, cylinders 18 x 24.

CARS

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6—12-yd. Western Hand Dump Cars.
12—24-in. gage Koppel Cars.
2—Atlas 2-yd. V-shaped Dump Cars, 36-in. gage.

BUCKETS

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1—1-yd. Lakewood Clam Shell Bucket, type C.
2—1-yd. Page Drag Line Buckets.

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1—50-hp. Economic type Boiler, practically new.
1—60-hp. Locomotive Type Boiler.
1—80-hp. Locomotive Type Boiler.
2—75-hp. Locomotive Type Boilers.

DERRICKS

1—American Stiff-Leg Derrick, 60-ft. mast, 70-ft. boom.
1—American Stiff-Leg Derrick, 70-ft. mast, 60-ft. boom, 12-ft. bull wheel.
2—American Stiff-Leg Derricks, 30-ft. mast, 40-ft. boom.

HOISTS

1—Clyde Electric, 100-hp.
1—7 x 10 National, D.C., S.D., with boiler.
1—6 x 10 Lidgerwood, D.C., S.D., with boiler.
2—Lambert Skeletons, 8½ x 10, D.D., D.C.
1—10 x 12 Flory, S.D., 2-speed skeleton.
1—12 x 12, D.C., 3-drum Stroudsburg, without boiler.

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1—Complete Pile Driver, 33-ft. leaders, 16 x 20-ft. carriage, Vulcan steel head block, 3700-lb. drop hammer, 8½ x 10, D.D. American hoisting engine

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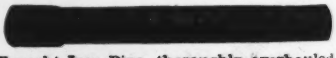

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Two Electrically Equipped 12½-ton
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Suitable for Power House or Shop Crane
Westinghouse Hoist and Traverse
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110 volts D.C. Dimensions 4 ft. 10¼ in. center to center of track, overall 6 ft. 8 in. wide, 5 ft. 6 in long. Thirty-foot lift.

First-class condition. Immediate delivery.

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10 x 20 Champion **Crushing Outfit**, with elevator screens, bin, engine and boiler, all on wheels. Used 1 season. $2250.
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Clam, Derrick and Engine Outfit 7 x 10 **Lidgerwood** D.D., with boiler and swinger, holding drum, stiff-leg with 40-ft. boom and ½-yd. Hayward clam, A-1. $2200.
5-ton Iroquois Tandem **Roller**, used only 2 months. $1800.
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2—6-hp., 1—8-hp. Boss Gasoline Hoists.
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4—½-yd. Contractors tip-over Buckets
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1—5-ton stiff-leg Derrick, 48-ft. boom
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1—No. 7 Pulsometer Pump, rebuilt
1—Each Nos. 4, 5 and 6 Pulsometer Pumps

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1—10-ft. Lansing Concrete Mixer, on trucks with gasoline engine
2—8-ft. Boss Mixers, gasoline engine and hoppers, on trucks
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Steam Shovels, Dragline and Trench Machines Locomotives, Locomotive Cranes, Dump Cars, Hoisting Engines, Derricks, Buckets, Air Compressors, Concrete Mixers, Crushers, Boilers, Engines, Pumps, Road Machinery, etc.

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2—Boilers. One vertical and one horizontal, about 50 and 60 hp.

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All guaranteed in good condition.

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One ten-ton Austin Western Gas Motor
ROAD ROLLER
with differential gear and one Austin three-ton
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all in first-class condition, bought new one year ago.

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Austin 00 now on government work at Camp Humphries, Va. Available after Dec. 1, 1918

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1—8 and 12 x 6 x 10 Worthington Compound Duplex Piston Pattern Pumps, for 150-lb. water pressure.

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3-yd. orange peel bucket with pair of 12 x 24 hoisting engines; 90-hp. locomotive boiler, hull 83 x 34 ft.

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1—Steel Car Tank, 7 ft. dia., 25 ft. long, with dome not mounted.

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1—25-ton Vilter Corliss Horizontal Ice Machine.

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2 Morris Centrifugal Pumps Four Stage Type

4-in. suction, 3-in. discharge, arranged with couplings and bedplates for direct connection to motors.

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1—Porter, 7 in. x 12 in., saddle tank
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1—American, 10 in. x 16 in. Forney type, 25 ton

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2—Vulcan 12 in. x 16 in. twenty-five ton saddle tank
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200—Flat Cars, 50,000 lb. capacity
15—Flat Cars, 60,000 lb. capacity
60—Gondola Cars, 80,000 lb. capacity
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2—Brown-Hoist 15 ton, 8-wheel, 40 ft. boom
1—Industrial 7½ ton, 4-wheel, 40 ft. boom
1—Industrial 10 ton, 4-wheel, 20 ft. boom
1—Electric 20 ton 4-wheel, ten ft. ga., 58 ft. boom

HOISTING ENGINES

1—5½ in. x 10 in. Mundy D.D., D.C. with boiler
1—6½ in. x 12 in. Mundy D.D., D.C. with boiler
1—6½ in. x 8 in. Lidgerwood D.D., D.C. with boiler
1—7½ in. x 10 in. National D.D., D.C. with boilr
1—6½ in. x 10 in. Mundy D.D., D.C. with boiler
2—8 in. x 10 in. Lambert D.D., D.C. with boiler
1—8½ in. x 12 in. Crook D.D., D.C. with boiler
1—9 in. x 10 in. Lidgerwood D.D., D.C., heavy hoisting
1—10 in. x 12 in. Flory D.D., D.C. with boiler
1—National Electric D.D., with swinger
1—Mead-Morrison Electric D.D., 11 H.P.

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1—Steel Guy, 102 ft. mast, 92 ft. boom
1—Steel Guy, 66 ft. mast, 54 ft. boom
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One Epping-Carpenter duplex cross compound Corliss Pumping Engine, size steam cylinders 22/41 in., water plungers, 10½ in., stroke 36 in., capacity 2200 gallons per minute at 41 r.p.m. Pump end good for 200 lb. pressure. Pump originally designed to operate with 140 lb. steam pressure non-condensing. This machine is in first-class shape, having been operated not over 90 days. Ready for immediate sale.

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60-ft. boom, 1½-yd. capacity bucket.

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Fore and aft compound, 12-in. stroke, 9-in. high pressure cylinder, 18-in. low pressure cylinder

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Frames, weights and engines
Good for 120-ton load. Two each of the following girders: 59 ft. 6 in., 70 ft. 3 in., 87 ft. 6 in., 91 ft. 6 in., 107 ft. 6 in., together with floor bracings.

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A good drainage machine in excellent condition. My work now completed.

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1—Marion 75—42-ft. boom 30-ft. sticks.
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2—Bucyrus 70—2½-yd.
2—Marion 60—2½-yd.
1—Marion 41—1½-yd.
1—Marion 40—1½-yd.
1—Marion 40 Traction.
2—Osgood 18—¾-yd.
2—Marion 28—¾-yd.
1—Thew No. 1—1-yd.
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Standard Gauge

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40—6-yd. K. & J.

36-in. Gauge

10—5-yd. Western Steel Underframe.
64—4-yd. Western.
21—4-yd. Western Heavy Duty.

30-in. Gauge

12—1½-yd. Western.

24-in. Gauge

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36-in. Gauge

4—Porter 11 x 16—21-ton.
3—Porter 10 x 16—18-ton.
1—Porter 9 x 14—14-ton.
2—Vulcan 11 x 16—21-ton.
1—Vulcan 10 x 16—18-ton.
1—Vulcan 12 x 18—27-ton.
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3—70-ton Hart Convertible Ballast Cars.
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Combination Steam Shovel

LOCOMOTIVE CRANE

Type B Erie. Combination steam shovel locomotive crane, shop No. 258, built 1917. Mounted on four broad tired traction wheels, has 32 ft. straight steel locomotive crane boom, ¾ yd. Owen clamshell bucket, also has standard shipper shaft steam shovel boom, ¾ yd. dipper with 12 ft. 6 in. dipper stick (never used). Engines and drums equipped for two line clamshell work, also power drum for raising and lowering boom, butt strapped boiler, pass any City. Machine has only seen 140 days' service. Can be inspected working as crane. Immediate shipment from Central Wisconsin. Truck frame can be fitted with standard gauge railroad wheels, procurable from Ball Engine Co. We own this crane and offer same subject to prior sale. Mechanical condition guaranteed. Revolving and self-propelling. Terms cash.

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Brown Hoisting, 3-ton electric, 4 wh., 26 ft. boom.
Browning, 15-ton, 4 wh., 45 ft. boom.
Industrial, 20-ton, 8 wh., 40 ft. boom.

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Stiff-Leg, 50 ft. boom, 12 x 12, legs 10 x 10.
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Mundy, 7½ in. x 12 in., D.D., D.C., with boiler.
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Marion, 1¼ yd. dipper, 38-ton capacity.

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Velie, 4-ton, without hoist, 1917 model.

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2000 cu.ft. steam-driven air compressor.

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6—2½ yd. Lockwood Bottom Dump Concrete Buckets.

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3—1½ yd. Side Dump 30 Gauge Cars.

HOISTS

50 hp., 220 volt D.C. Electric Hoist, two drums and swinger.
40 hp. Lambert, 220 volt D.C. Electric Hoist, double drum.
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7 x 10 American, D.C., S.D., Hoist.
6 x 12 Parker, D.C., D.D., Hoist, with boiler.
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200 hp. Manning Upright Boiler.
100 hp. Portable Marine Type Boiler
30 hp. Portable Boiler, nearly new.

Worthington Compound Duplex Steam Pump, 1800 gal. per minute.

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200 hp. G. E. A. C. Motor.

1000 other machines of all kinds.

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LOCOMOTIVE CRANE

20 ton, 8 wheel Ohio M. C. B. bucket operating,
3 years old, 40 ft. boom

PRICE $18,000

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One never used, other good as new, except has crack in upper bearing frame which may be welded and re-babbitted at nominal cost.

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1—6 x 8 **Hoist,** 24 x 20 drum, Lake Shore Engine Works make.

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110—Standard gauge, 12-yd. capacity, all steel two-way dump cars.
3—Standard gauge, 50,000 capacity, flat cars.

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4—Locomotives, consolidation, type 208, Baldwin make, 80 tons.
9—Standard gauge, Mogul type, 61 tons.

LOCOMOTIVE CRANE

1—American Hoist and Derrick, 15-ton, 8-wheel, 40-ft. boom, clam shell operating, standard gauge. Location Pennsylvania. Immediate delivery.

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2—Type O Thew shovels, ¾-yd. bucket.
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2—14-in. x 14-in. stiff-leg **Derricks,** 60-ft. boom, complete with bull wheel.
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1—278-cu.yd., 6-pocket **Dump Scow.**
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1—**Tug Boat,** 50 ft. long by 9 ft. 6 in. beam.
1—Ransome **Concrete Paver,** No. 60 (traction), complete with chute.
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Diaphragm, Duplex and Centrifugal Pumps, all sizes.

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STEAM SHOVEL

2½-c.yd. dipper, good as new.

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1—Marion model 31 shovel, 1½-yd. dipper, standard gauge railroad trucks.
2—9 x 14 Porter locomotives.
25—Continental dump cars, four (4) yard capacity.

All f.o.b. cars their present location, $10,000.

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1—450 Kw. General Electric, 3 phase, 2300 volts, 100 r.p.m. dir. conn. to 22 in. & 42 in. x 48 in. E. P. Allis cross compound engine.
2—340 Kva. Westinghouse, 3 or 2 phase, 220 volts, 150 r.p.m., Engine type. No engines.
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1—120 Kw. Allis Chalmers-Bullock, 3 or 2 phase, 2400 volts, 277 r.p.m. Engine type. No engine.
1—50 Kw. Ft. Wayne, 3 or 2 phase, 2300 volts, 300 r.p.m., dir. conn. to 11 in. x 12 in. Chuse horiz. engine.
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1—Rand, cross compound, 2-stage, 22 x 40 x 39 x 24 x 48-in., class RBB-3, 65-r.p.m., steam end designed for 150-lb. steam pressure condensing, air end 80 lb., capacity 4000 cu.ft.
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1—Ingersoll-Rand straight line, class A-1, 20 x 22¼ 24-in., capacity 1000 cu.ft. air per min. at 85 to 100-lb. pressure.
1—Clayton, duplex, 2-stage, 10 x 18 and 10 x 10-in., 175-r.p.m., capacity 545-cu.ft. per min. at 185 r.p.m., 90-lb. pressure.
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Boilers—Locomotive and Water Tube.
Derricks—Guy and Stiff-leg.
Hoisting Engines.
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Also One Type A1 Thew Steam Shovel.

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ELECTRIC TRAVELING CRANE

1—Alfred Box, 4-motor, 25-ton Crane, with 5-ton Auxiliary Hoist, 52-ft. span, 220 volt D.C. In good working order, delivery sixty days.

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FOR SALE

LOCOMOTIVE CRANES

2—15-ton Brown Hoist Locomotive Crane, 45 ft. and 50 ft. booms, full M.C.B., 8-wheel, std. gauge, with auxiliary drum, first-class condition.

CLAM-SHELL BUCKETS

1—1-yd. Class E, Hayward Clamshell Bucket.
1—1-yd. Class E, Hayward Orange Peel Bucket.
1—½-yd. Meade-Morrison Clamshell Bucket.

JOHN M. GREENE
261 Drexel Bldg., Philadelphia, Pa.

HOISTING ENGINES

1—Lidgerwood, 14 x 18, D.C., three-tandem drum, suitable for cableway.
1—Shannon, 7¼ x 10, D.C., D.D., with boiler.
1—Mundy, 6¼ x 10, D.C., D.D., skeleton.
2—Mundy, 6¼ x 10, D.C., D.D., with boilers.
1—National, 5½ x 10, D.C., D.D., with boiler.
1—Mundy, 8 x 12, double cylinder, 3 tandem drums, butt strapped, triple riveted boiler, independent Mead-Morrison 4½ x 6 swinging engine, equally as good as new.

BOILERS

3—American-built Scotch type marine boilers, 12 ft. 6 in. dia. x 20 ft. long, double end, three corrugated furnaces each end, 160 lb. steam.
1—350-hp. horizontal return tubular boiler, 125 lb. steam.

ANCHORS

10—New Mushroom Anchors, 5000 lb. each.

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6000 ft. strictly first-class 6-in. wrought steel pipe, equally as good as new.
700 ft. strictly first-class 20-in. dia. steel riveted flange pipe, lengths 20 ft. each.
400 ft., 24-in. dia., 30-ft. lengths, equally as good as new.

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1—350-hp. Greene Slide Valve Engine, equally as good as new, size 22 x 48 in., wheels 16 ft. x 3 in.

STEAM SHOVELS

1—65-ton Bucyrus, 2½-yd. dipper, standard gage.
1—No. 1 Thew traction steam shovel, 1 yd. dipper.

CENTRIFUGAL PUMP

1—Morris No. 12, 14-in. suction, 12-in. discharge, direct connected to horizontal engine, 18 x 10, 4500 gallons capacity per minute.

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34—4-wheel standard gage car trucks. Wheels 24-in. diameter, in first-class second-hand condition.

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15 Reels ⅝-inch

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6 x 37—6 x 19—8 x 19

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11-30-60-hp. Lambert, D.D., 220-volt, D.C.
60-hp. Lidgerwood, D.D., 220-volt, D.C.
40-hp. Lambert, S.D., 220-volt, D.C.

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1—Ingersoll-Rand, capacity 2570-cu. ft., 500-hp., 2200-volt, A.C. motor, belt 48 in. diam.
3—Sullivan Class W.G.-3, 152-cu.ft. F & M. 25-hp. Diesel oil engine, belt driven.
1—Sullivan Class W.G.-4 340 cu.ft. 100 h.p. G.E. 220-volt, belt driven.

STEAM SHOVELS

1—Thew ⅞ Bucket.
1—Vulcan.

BOILERS

10-15-hp. Vertical.
50-60-80-hp. Locomotive.

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G. E. and Westinghouse, 1¼ to 25-hp., D.C.
30 to 50-hp., A.C.

ENGINES (Hoisting)

Lambert and Lidgerwoods.
8¼ x 10, D.D. and swinger, with boiler.
8½ x 10, D.D. and swinger, with boiler.
7¼ x 10, D.D. and swinger.
9½ x 10 triple drum.

CONCRETE MIXERS

¼, ½, 1-yd. Mixers, gas, electric and steam driven.

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Centrifugal, Duplex, Force, Diaphragm in gas, steam and electric. 8 to 3 in. discharge.

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4-yd., 36-in. gage W. & K. & J. Dump Flat Cars.

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3½, 6, 12-in. (good condition)

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2—No. 1 Vulcan Steam Hammers.
2—72-ft. Leaders, complete.

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IMMEDIATE SHIPMENT

2—15-ton, 8-wheel Brownhoist

LOCOMOTIVE CRANES

with 1½-yd. bucket, 50 ft. booms.

1—Type "B" Erie Revolving

STEAM SHOVEL

equipped with standard steam shovel dipper handle and ¾-yd. dipper, also new locomotive crane, boom and clamshell.

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Lidgerwood Hoisting Engine

Size No. 371½ double cylinder 7 x 10-in. double friction drum, skeleton type, hoisting engine, with No. 4 Swinging Gear in front. Approximately 300 ft. of ⅝-in. hoisting rope on each drum. All first class. Price $800. Immediate delivery. F.o.b. Jersey City, N. J.

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20 Hoisting Engines — 10 Air Compressors
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LARGE CABLE ENGINE

for mining purposes, will accomodate two miles of 1 in. cable.

Largest line of Contractors' Equipment in good condition, of any dealer in New England.

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8 Ton, 36-ft Mast, complete with Blocks and Cables, together with a 1—D.C., 4D Lambert

HOISTING ENGINE

Cylinders 7 x 12; no Boiler.

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Various Sizes and Quantities

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300 ft. of 10 in. I-Beams

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2—20-ton McMyler, 50-ft. boom.
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1—10-ton McMyler, 32-ft. boom.
All bucket handling.

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Standard Gauge

50—12-yd. Western Steel Frame, Chicago.
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40—6-yd. K. & J. Steel Frame, New York.
20—12-yd. K. & J. Steel Frame, Alabama.

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20—4-yd. Western Steel Frame, New York.
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Several other items. Also 24-in. gauge.

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10—6-wheel Switchers, 160-lb. pressure and more. Baldwin, Davenport, American, 45/70 tons.
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10—20 tons. Baldwin, Porter and Vulcan.
Several 24-in. gauge Gasoline and Steam Saddle Tank and Mine Locomotives.

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3—70-C Bucyrus, 3-yd. dipper, Pa.
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3—Erie Type B, Central East.
3—Marion No. 28, Central East.
1—Marion Model 40, 1—Model 30, 1—Model 60, 1—Model 76.
4—Vulcan, 3/4-yd. to 1 1/2-yd. dippers.
2—Osgood No. 18.

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12—464-hp. Stirlings, 150-lb. pressure.
2—500-hp. Heine, 160-lb. pressure.
8—350-hp. B. & W., 160-lb. pressure.
2—40-hp. Locomotive type, 100-lb. pressure.
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1—30-hp. Locomotive type, on trucks.

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200 tons, 70-lb., Ohio.
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DOUBLE DRUM HOISTS
1—30-hp. 5-50-hp., D.C., 220-volt.
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7—Swinging Gears for same.

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3075 ft. 1-in. (lengths 525 ft. to 1000 ft.) second-hand
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(Easily changed to electric drives.)

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3—2-line, Stiff-Leg Derricks, with booms 51-ft. 10-in.—56-ft. 4-in.—55-ft. 3-in., with wood bull wheels, load and fall blocks, $700.
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Vertical, 5 to 50 hp.
Hor. Ret. Tub., 150-125 hp.
Portable, 100-40-15 hp.

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1—6½ x 10 D. C., D. D. Lambert.
1—6½ x 12 D. C., D. D. Mundy.
2—7 x 10 D. C., D. D. Lidgerwood.
2—7 x 10 D. C., D. D. Orr & Sembower.
1—8 x 12 D. C., D. D. Flory.
1—8¼ x 10 D. C., D. D. Lidgerwood.
1—8½ x 10 D. C., D. D. Crook Cableway.
1—9 x 10 D. C., D. D. Lidgerwood.
1—8½ x 13 D. C., 3 D. Mundy.
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1—5½ x 8 D. C., D. D. American.
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1—No. 203 Lidgerwood Swinging Engine.

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1—¾-yd. Chicago Cube on wheels.
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27—42-in. gauge 1-ton low vein Mine Cars.
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4—36-in. gauge 1½-yd. "V" Shape.
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1—Sullivan Gasoline Portable, 105 cu.ft.
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1—10-ton Byers Saddle Tank.
3—9 x 14 American.
2—9 x 14 Vulcan.
3—9 x 14 Porter.
1—10 x 16 Porter.
1—10 x 16 Baldwin.

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HOISTING ENGINES

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1—10 x 12 Flory, three drum.
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1—10 x 16 Crook, double drum.
1—9 x 12 Mead, double drum.
6—8¼ x 10 double drum Mead, American-Lidgerwood.
3—8¼ x 10 Lambert, double drum, with swingers.
3—7 x 10 American, double drum.

WITH BOILERS

1—7 x 10 double-cylinder, three-drum Mundy.
1—6¼ x 8 double-drum Mead-Morrison.
2—4¾ x 6 American, single drum, reversing.
1—8¼ x 10 double-cylinder, double-drum Lidgerwood.

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Derricks, fittings and timbers of all sizes and kind.

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1—Thomas, single drum, 35 hp., D.C., 220 v.
1—Mead, single drum, 15 hp., A.C., 3 ph., 60 cy., 220 v.

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5—4½ x 6 Mead, compound geared reversing swingers.
2—3 x 4 Mead, compound geared swingers.

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1—9 x 10 Lambert, double drum, reversing skeleton.
1—7 x 10 Mead-Morrison, double drum, reversing skeleton.

Prompt shipment assured.

BECKWITH MACHINERY COMPANY
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1—8¼ x 10, D.C., D.D., American Hoisting Engine, with boiler and swinging attachment.
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HOISTS

2—16-hp., D.C., D.D., Byers Hoists with Boilers.

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1—Stiff-Leg Derrick, mast 45 ft., boom 75 ft., 14 x 14 timbers.

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HOISTS

Compressors - Boilers - Mixers
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HOISTING ENGINES

1—Thomas 8¼ x 10, D.C., D.D., two-speed skeleton
1—Lambert, 7 x 10, D.C., D.D., with boiler.
2—16-hp., D.C., D.D. Hoists, with boiler.
1—Hayward Holding Drum.

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1—Lidgerwood two tower cableway, consisting of one 75-ft. tower and one 85-ft. tower, 34 sets of wheels with axles, carriage and carriers with 4-part fall block and aerial dump attachment, including slings and bridle for main cable. 900 ft. of 2¼-in. lock wire cable with 2 sockets attached. 1—Lidgerwood special 12 x 12 cableway engine, shop No. 30093-4. 1—button line.
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1—Complete crushing outfit, consisting of one Class K-Allis-Chalmers gyratory crusher No. 6, 1—No. 3 Crusher, complete with elevator, approximately 50-ft., and three section screen, with hoisting and driving apparatus, arranged for either steam engine or electric motor. Also 1 No. 6 McCully gyratory crusher; right angle drive.

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1—Wood guy derrick, with mast approximately 14x14 at base, 10x10 at top, with boom 80-ft. long, 10x10.
1—Wood guy derrick, with mast approximately 12x12, 60-ft. high, with boom 60 to 80-ft. long; 10x10; fitted with brass pushed sheaves and cable.
1—Guy derrick with mast 14x14 at base, 10x10 at top, with boom 10x10, approximately 60-ft. long, complete with all irons, turnable double block sheaves.

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30—Western and Oliver type all-steel 12-yd. dump cars, which we offer for sale or lease. These cars are located at various points in the East.

COIL CHAIN

A large quantity in all sizes up to 1¼-in.

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10,000 valves; all kinds and sizes.

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500,000 ft. of cable; sizes from ¼ to 2 in.

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3—95-ton Bucyrus Steam Shovels, 5-cu. yd. dipper.
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6—70-ton Bucyrus steam shovels; 2½-yd. dipper.

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40-ton, 40-lb. Relaying Rail.
350-ton, 35-lb. Relaying Rail.
80-ton, 25-lb. Relaying Rail.
60-ton, 20-lb. Relaying Rail.
15-ton, 16-lb. Relaying Rail.
10-ton, 12-lb. Relaying Rail.

LOCOMOTIVE CRANES

1—20-ton O. & S. 8-wheel; 42¼-ft. boom
1—40-ton Bucyrus, 8-wheel, 55-ft. boom
1—2-ton, 4-wheel railway type, 110-volt storage battery electric locomotive crane; boom 15-ft., full revolving with motors and controllers.

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1—Niles Electric Traveling crane, 46-ft. span, 15 ton cap. with auxiliary hoist 5-ton; 2 motors, 20-hp. 1—5-hp. for main hoist and 3-hp. for auxiliary hoist; voltage 220-D.C.

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50,000 feet, 1-in.	15,000 feet, 4-in.
35,000 feet, 1¼-in.	8,000 feet, 6-in.
65,000 feet, 2-in.	2,000 feet, 8-in.
48,000 feet, 2½-in.	3,000 feet, 10-in.
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13,000 feet 1¼-in. double extra strong seamless steel tubing, good for 5000-lbs. pressure, fitted with Briggs threads each end, and couplings.

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New full 2½-yd. two-line
Equipped for Derrick use.

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1 Model 70 Bucyrus
1 Model 60 Marion
1 No. 0 Thew
1 Erie with extra boom and clamshell bucket
1 Model 28 Marion
1 Keystone Grader
1—10-ton **Steel Derrick** complete, with 8¼ x 10 D. C., D. D. Lidgerwood Engine and Boiler
1—10 x 20 **Acme Crusher**, with elevator and screen
1½-yd Smith-Chicago **Concrete Mixer**, with engine and boiler on wheels

A large quantity of small equipment and tools.

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1—1yd. McMyler

CLAM SHELL BUCKET

Good condition. Price $675. Immediate delivery. **C. I. P. S. Co.**

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Narrow and Standard Gage for every service, rebuilt, immediate delivery.

Locomotive Cranes, Steam Shovels, Cars, Etc.

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INDUSTRIAL TRACK

50 sections, 13 ft. each, 24 in., 20 lb. Track, with Ties.
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8 sections, 15 ft. each, 30 in., 16 lb. Curves, with Ties.
2 sections, 10 ft. each, 24 in., 20 lb. Switches Complete.
2 sections, 10 ft. each, 30 in., 16 lb. Switches Complete.
10 Steel Dump Cars for 30 in. Track, and 2 Steel Platform Cars, 24 in. Track.

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1—**Hoisting Engine**
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1—**Insley Distributing Plant**, complete with 120 ft. tower
1—**Rock Drill**
3—**Derricks**
3—**Wagons** with self-dump beds.
1—**Rooter** and **other plows**
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Relayers—30, 35, 45, 60, 70 lb. per yd.
Frogs and Switches—To match sections.
Spikes—Standard sizes in stock.

FOR SALE

One 15-ton, one 13-ton, 36 in. Gauge Porter Saddle Tank

LOCOMOTIVES

In good running condition. Attractive price for quick sale.

Superior Coal Mining Co.
Washington, Ind.

LOCOMOTIVES

Immediate Shipment

Standard Gauge
1—20-ton Shay.
1—11 x 16 Baldwin Saddle tank.
1—14 x 24 Davenport Saddle tank.
1—18 x 24 Baldwin Six-Wheel Switcher.
Delivery—45 days.
1—18-ton O. & S. **Locomotive Crane**, 8-wheel M. C. B.

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(First-class Used)

LOCOMOTIVE CRANE

C-1—1—McMyler-Interstate 15-ton type F, 8-wheel Standard Gauge, 40-ft. boom. Two years old.

STEAM SHOVELS

C-21—1—Thew Model "O," ⅝-yd. dipper. Age 6 years. Excellent condition.

C-21-a—1—Marion Model 28, ¾-yd. dipper. Age 1½ years. Excellent condition, practically new.

C-28—1—Bucyrus 175-B, 3½-yd. dipper, 75-ft. boom. Good condition.

C-34—1—Erie type B, revolving type on traction wheels. Almost new.

C-31—1—Bucyrus Model 65, Railroad type, 2½-yd. dipper, 30-ft. boom. Good condition.

C-6—1—Bucyrus Model 150 B, 2½-yd. dipper, 65-ft. boom, revolving type. Good condition.

C-29—1—Marion Model 250, 3½-yd. dipper, 65-ft. boom. Good condition. Can be seen operating.

LOCOMOTIVES

C-13—1—8 in. x 14 in. Porter Saddle Tank Locomotive, 30 in. gauge. Excellent condition.

C-11—1—18 in. x 24 in. Rome Works, Mogul Locomotive, Standard gauge. Just overhauled.

C-4—1—15¼ in. x 16 in. Climax (80-ton) Geared Locomotive. Standard gauge. Excellent condition.

C-41—1—9 in. x 12 in. (23-ton) Climax Saddle Tank Locomotive. 42 in. gauge. Good condition.

C-38—1—19 in. x 26 in. Brooks, class 2-8-0 Locomotive. Standard gauge. Recently repaired.

C-39—1—18½ in. x 24 in. UP, class 4-4-0 Locomotive. Standard gauge. Recently repaired.

RAILWAY & MINE SUPPLY COMPANY
332 So. Michigan Ave., Chicago *Tel. Harr. 7382.*

FOR SALE

1—9 x 14

PORTER DINKEY

36-in. Gauge, A-1 condition, also

3 Miles of

RELAYERS

with ties, prompt delivery; can be seen at

Instanter, Elk Co., Pa.
Write **T. H. QUINN & CO.**

RAILS

40 tons	16-lb. New.
150 tons	20-lb. New
100 tons	56-lb. Relayers
500 tons	60-lb. Relayers
25 tons	75-lb. New
30 tons	85-lb. Relayers
200 tons	90-lb. New
40 tons	100-lb. New

HENRY LEVIS & CO.
Commercial Trust Bldg., Philadelphia, Pa.

RELAYING RAIL

170 gross tons 60-lb. 5¾-in. high Relaying T-Rail, with continuous joint plates; in good, serviceable relaying condition, but will not pass Hunt's inspection. Price $48.40 per gross ton, f.o.b. cars East St. Louis, Ill.

ARTHUR S. PARTRIDGE
415 Pine St., St. Louis, Mo.

RELAYING RAILS

We have for immediate shipment:

250 tons of 30-lb.
150 tons of 35-lb.

Complete with splice bars.
Atlanta (Ga.) Delivery
Write or Wire for Price

THE ISAAC JOSEPH IRON CO.
525 Reading Rd., Cincinnati, O.

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85 lb. A.S.C.E. Relayers

16,000 tons—with Angle Bars to match.
Available immediate shipment and centrally located.
We positively own these Rails and offer same in carload lots and over.
25,000 tons—Relayers—sizes 25 lb. to 100 lb. in stock at our Pittsburgh Yards and vicinity. Immediate shipment guaranteed and prices very attractive.
Carload and less than carload inquiries and orders solicited.
Rails cut to length for structural purposes.
Frogs, Switches, Bolts, Nuts, Spikes and all Accessories.

L. B. FOSTER COMPANY
Park Building, Pittsburgh, Pa.

FOR SALE

1000 Tons of 80-lb.

RELAYING RAILS

Good as new, with Angle Bars.

For Immediate Shipment.

R. C. HOFFMAN & CO.
Baltimore, Md.

RAILS

All sections, new and relaying.
For immediate shipment.

M. K. FRANK, Frick Bldg., Pittsburgh, Pa.

RAILS RAILS RAILS

On hand in Albany, large stock of contractors' rails.
Rails cut to length for concrete or buck stays. Write or wire for prices.

United American Iron & Steel Co.
750 Woolworth Bldg., New York, N. Y.

Contractors' Equipment

For Immediate Delivery

DUMP CARS

20 Western standard gauge, 12-yard, 2-way Dump Cars; 19-ft. beds; steel underframe; with or without air dump.

DINKEYS

3—9 x 14, 4-wheel saddle tank, 36-in. gauge modern engines, thoroughly overhauled; one Porter, one Baldwin, one American.

LOCOMOTIVES

1—20 x 24 Pennsylvania Consolidation 64-Locomotive, thoroughly rebuilt, immediate shipment.

1—15 x 22 Baldwin, short coupled Mogul; 11-ft. rigid wheel base, 38-in. wheel centers, new fire-box, new tires, excellent engine; 180 lb. steam, immediate shipment; sloping back tender.

We have a large stock of other equipment.

Birmingham Rail & Locomotive Co.
Birmingham, Ala.

New 80,000 lb. cap. steel underframe GONDOLA CARS

E. H. WILSON & COMPANY
COMMERCIAL TRUST BUILDING
PHILADELPHIA

For immediate shipment we offer 128 of these cars. Never in service. Meet M. C. B. and I. C. C. requirements. Flat bottom, 42 ft. over end sills, 2 ft. 6 in. sides.

Shall we send full specifications, photographs and price?

FOR SALE.

30,000 ft. of 20 lb. portable Track, 24-in. gage, in first-class condition.
50—1½-yd. Koppel Cars.
4—3-ton Plymouth Locomotives.
1—5-ton Whitcomb Locomotive.
1—¾-yd. Erie Steam Shovel.
Cars, Shovel and three of the Locomotives bought new little over year ago.
THE HILL DREDGING CO.
Somerset and Atlantic Aves., Ventnor, N. J.

FOR SALE

1—No. 1 Snipper Shaft Boom, Thew Automatic **Traction Shovel**, shop No. 834, used only on one job, good as new.

1—No. 1 Trolley Boom Thew Automatic **Shovel**, shop No. 538, new boiler and new boom, first-class condition.

1—Vulcan narrow gauge **Locomotive**, 12 tons, cylinders 9 in. x 13 in. good working condition.

1—Porter **Locomotive**, 14 tons, cylinders 10 in. x 13 in., good working condition.

5—Two-way Continental **Dump Cars**, good condition.

About 1 mile of 40-lb. **Rail**, including **Switches**, **Fish Plates** and **Ties**, good condition.

3—Special **Thew** "O" ¾-yd. Dipper, high lift, counter weighted for deep trench work, shop Nos. 1320, 1321 and 1322, first-class condition, will load wagons on bank in 14-ft. cut.

1—10-ton Buffalo Pitts **Roller**, new, used only on one job, good as new.

1—12-ton Julian Schoel Road **Roller**, good condition.

1—No. 1 **Thew**, special high lift, counter weighted, has deep trench dipper and dipper stick, shop No. 839, first-class condition.

1—No. 4 Thew Special **Shovel**, 2-yd. dipper, solid steel throughout except house, cone drum, steam ram friction, railroad trucks, jack arms, first-class condition

2—Pierce, 5-ton Sand **Trucks**, nearly new.

1—No. 10 Sunbury Automatic **Car Unloader**, never used.

JOSEPH F. STABELL CO.
1105 Niagara St., Buffalo, N. Y.

FOR SALE

NEW FABRICATED

STEEL

FOR TWO BUILDINGS

1—Heavy Building, 46 ft. 8⅜ in. x 145 ft., 69 ft. 10 in. to lower chord of truss. Weight of steel about 300 tons.

1—Light Building, designed for three stories, 21 ft. 8⅛ in. x 220 ft., 37 ft. 3 in. to lower chord of truss. Weight of steel about 130 tons.

Buildings are in our plant, but have never been erected. Rivets, Bolts and Working Drawings can be furnished.

Immediate delivery can be made.

SIZER FORGE CO.
Buffalo, N. Y.

FOR SALE

STEEL SKEW BRIDGE

Whipple Double Intersection Truss, 143 ft. long, 23 ft. wide, skew 67 deg.

This truss is in excellent condition but is being replaced by a much larger concrete bridge.

For full particulars write to

McKinnon Construction Company
Providence, R. I.

Yellow Pine Piling

In stock for prompt shipment

330 pcs. 40 to 60 ft. 12 in. butt.
215 pcs. 61 to 70 ft. 13 in. butt.
190 pcs. 71 to 80 ft. 14 in. butt.

Write for delivered price.

FRED D. SNODDY
ATMORE, ALA.

FOR SALE

STEEL SHEET PILING

All Lackawanna Arch Web
100-Tons 27 to 35 ft.
70-Tons 16 to 22 ft.
First-class condition.

J. T. WALSH
246 Tremont St., No. Tonawanda, N. Y.

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EQUIPMENT

and Second-Hand

Steam Shovels
Locomotives
Locomotive Cranes
Hoists—Steam and Electric
Cars—Mine, Quarry and Contrators'
Crushers—Other Quarry Equipment
Boilers and Engines

General line of contractors and mine supplies and equipment

Send Us Your Inquiries.

JOHN J. IRVIN COMPANY
Bellwood, Pa.

TANKS

8—Tanks, 10 x 16-ft.
8—Tanks, 10½ x 16½-ft.
2—Tanks, 14 x 10½-ft.
1—Pressure Tank, 6½ x 24-ft.
All Stock for Immediate Shipment

PEERLESS IRON & METAL CO.
552 Penobscot Bldg., Detroit, Mich.

STEAM SHOVELS

70C Bucyrus, in Colorado.
40R Bucyrus, in Wyoming.
Model 31 Marion, in Wyoming.
Model 60 Marion, in Colorado.
Model 40 Marion, in Utah.
Osgood ¾ yd., in Utah.
2—Class E Vulcan, in Montana.
2—Little Giant Vulcan, in Montana.

DUMP CARS

42—Western, 4 yd., 36 in. ga., in Colorado.
30 K. & J. 4 yd., 36 in. ga., in Colorado.
6—Peteler, 4 yd., 36 in. ga., in Colorado.
12—Western, 1¼ yd., 24 in. ga., in Colorado.

LOCOMOTIVES

3—50 ton Rome Switchers, in Colorado.
2—20 ton Davenport Dinkeys, in Colorado.
1—20 ton Vulcan Dinkeys, in Colorado.
2—18 ton Vulcan Dinkeys, in Colorado.
2—18 ton Davenport Dinkeys, in Colorado.
Elevating Graders, Dump Wagons, Steam and Gasoline Hoists, Derricks, Concrete Mixers, etc., etc.

Intermountain Contractors Equipment Co.
16th and Wazee Streets, Denver, Colo.

For Immediate Delivery

LIFTING MAGNET

One (1) new 43-in. E. C. & M. Co.'s Lifting Magnet, complete with panel and switch, 220 to 250 D.C.

CLAMSHELL BUCKET

One (1) 1¼-yd. Williams Clamshell Bucket.

MACHINE BOLTS

Approximately 4500 Brand New Machine Bolts, 7½-in. long under head by 1¼ in. in diameter with U. S. Standard cold punched hexagon nuts.

THE FACTORY PRODUCTS COMPANY
203-204 Oliver Building, Pittsburgh, Pa.

FOR SALE—12—48-in.

PLATE GIRDERS

60 ft. long, ½-in. web, 6 x 6 x ⅝-in. angles, ⅝-in. cover plates, section Modulus 1138, weight per foot about 270 lb.; also Stiffener angles.

Holbrook, Cabot & Rollins Corpn.
52 Vanderbilt Ave., New York, N. Y.

STEAM SHOVELS

1—65-ton Bucyrus Steam Shovel, with Mass. boiler
1—Model "76" Marion Steam Shovel, with Mass. boiler, 100 tons 30-lb. rail

MIXER

1—1-cu.yd. Chain-Belt Mixer, with 25-hp., 230-volt, D.C. motor

LOCOMOTIVE CRANE

3—Brown Hoisting Machinery Co., type "A," 4-wheel, standard gage, 3-ton, electric locomotive crane, boom 23 ft. 6 in. with General Electric 37-hp., 450-r.p.m., 220-volt, D.C. motor.

CRUSHERS

1—No. 6F and 4D Kennedy Gyratory Crusher.
1—Symons 5C Portable Gyratory Crusher, complete

COMPRESSOR

1—Ingersoll-Rand, 17½ x 10½ x 16-in., Class PI-2 878-cu.ft. at 100-lb. pressure with 150-hp., 220-volt, 565-amp., direct current, 225-r.p.m., type N.P. General Electric motor.

HOLBROOK, CABOT & ROLLINS CORPORATION
52 Vanderbilt Ave., New York, N. Y.

FOR SALE
2—Vulcan No. 2

Steam Pile Hammers

MACHINERY RENTAL & SALES CO.
Industrial and Contractors' Equipment
2918 Southwest Blvd., Kansas City, Mo.

Don't Be Ridiculous

Every once in a while some fellow who is not up to date in the matter of mill building and equipment makes the wise ones laugh by saying:—

"YOU CAN'T TURN STEAM INTO A TANK CONTAINING WATER WITHOUT EXCESSIVE condensation and great loss."

Oh, ye shades of Stephenson and his locomotive!

Of Fulton and his steamboat!

Of Langley and his aeroplane!

Lots of engineers don't know these simple facts:—

Steam and air in a closed vessel UNDER PRESSURE do not mix notwithstanding the law of the diffusion of gases.

Air is twice as heavy as steam.

Air is an almost perfect non-conductor of heat.

"Catch on?" It is the Ridgway discoveries and the Ridgway patents that make the Steam Hydraulic the greatest of elevators.

THE FRANKLIN INSTITUTE OF PHILADELPHIA, the oldest and greatest engineering society in the U. S., knew what it was doing when it awarded the Ridgways of Coatesville its high honor for producing one of the great inventions of this great century.

And besides, here is a sample of the 2000 and more great establishments

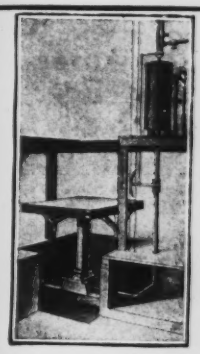
United Gas Improvement Co.	Procter & Gamble Co.	United States Government
Yale & Towne Mfg. Co.	H. J. Heinz Co. "57"	E. I. Du Pont & Co.
Cluett, Peabody & Co.	International Harvester Co	General Electric Co.
B. F. Goodrich Co.	John Wanamaker	Packard Motor Car Co.
National Cash Register Co.	Remington Typewriter Co.	Continental Can Co.
Hammermill Paper Co.	Continental Gin Co.	Solvay Process Co.
	Erie Railroad Co.	John Morrell & Co.
	Crane & Co. (Dalton)	

who will tell you mighty quick that if you have steam and an elevator proposition you should be sure and

"Hook 'er to the Biler."

CRAIGE RIDGWAY & SON CO., Coatesville, Pa.

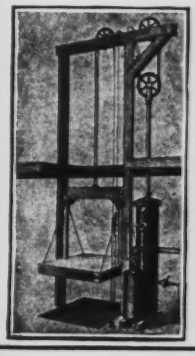
ELEVATOR MAKERS TO FOLKS WHO KNOW

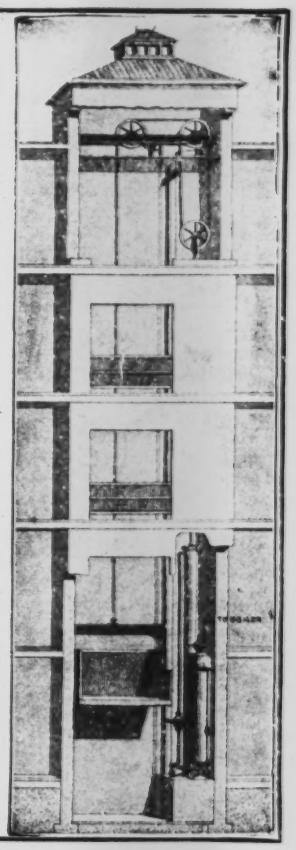


Direct Acting

Over 2000 in Daily Use

Double Geared



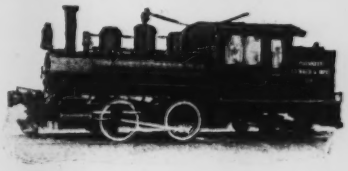


Are You Harboring Any of These "Slackers"?

These are 100% efficiency days.
That's why the Work-or-Fight law.
The man who can't FIGHT must WORK!
The same applies to equipment:
Make it WORK or "SCRAP" it!
Every bit of idle machinery or material is "SLACKER" equipment.
Put it to work—AT ONCE!
If you own "SLACKER" equipment—that **you** cannot use—sell it to the man who needs it and for whom it will render a **real service.**

The Searchlight Section of this paper is consulted each week by many—including U. S. Government Departments—who have immediate need for equipment that cannot be had from manufacturers. You may have just what they need.

420



All sizes and types of light steam

LOCOMOTIVES

LOCOMOTIVE CRANES

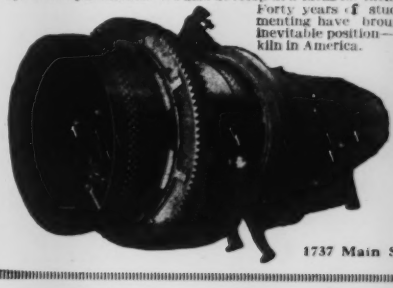
Davenport Locomotive Works

Davenport, Iowa

VULCAN KILNS

Maximum production and quality are assured wherever **Vulcan** Kilns are installed.

We are kiln specialists: We design and build special or standard types to meet specific requirements. We also develop new ideas for their use.



Forty years of study, labor and experimenting have brought "Vulcans" to their inevitable position—the most widely used kiln in America.

Our engineers are ready and willing to assist and advise you. Vulcan manufacturing facilities and skilled workmen are at your service.

Write us now without pay or obligation. Your request will bring a fund of kiln information.

VULCAN IRON WORKS

1737 Main St. Wilkes-Barre, Pa.

Why Not Use the Draw Bar Pull You Already Pay For?

You already have the power and the driver. Every time your truck delivers a load except on extremely bad roads and grades, it is wasting enough power to draw not one, but four trailers. Why not take advantage of this opportunity

WATSON UNIVERSAL SERVICE TRAILERS

offer. The outlay is small and you are bound to save money all along the line. They are designed for use behind any motor tractor or tractor unit and will outlive the trucks that draw them.

Watson Wagon Company
20 West Center St., Canastota, N. Y.

Du Pont *says*—

"Replying to your letter of October 12th in regard to Lightning Loader Skips, which we have been using. We wish to state that we have had a number of these in use unloading cinders, gravel and sand and have found them very satisfactory.

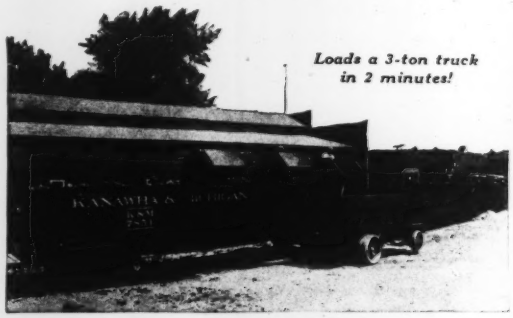
"The cost of Operation of the Loader compared with the cost of hand labor, we cannot give you as no data of this kind was ever kept. Offhand, we would say that the loader will replace three men."

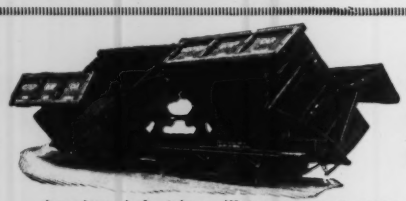
LIGHTNING
Loaders and Unloaders

save the Du Pont Powder Company the cost of 3 men per day each! Do you wonder that they gladly express their approval of such economical performance?

And labor cost is only one expense that is reduced. They keep things on the move—trucks as well as men—no idling—no lost time—and the job of handling your material requires just a fraction of the time. Send for information and prices today.

Heltzel Steel Form and Iron Co.
Warren, Ohio





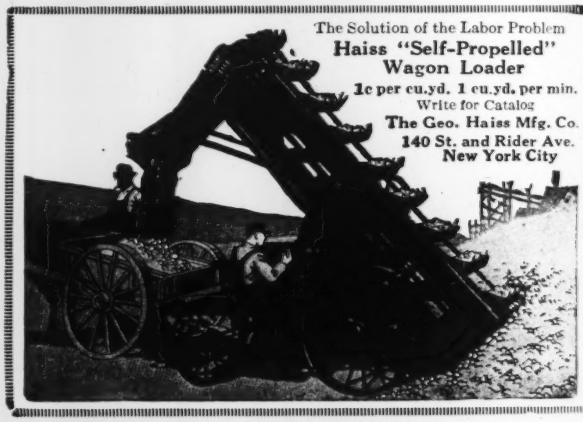
Are You Ready For Peace?

American industries will have to cut every corner after the war or be left behind in the race for commercial supremacy.

How do you handle material?

That is the neck of the bottle, for it governs your output. Western Dump Cars, made in all practical sizes to meet conditions, are especially adapted for within-the-plant transportation. They save labor and money. Let's talk it over.

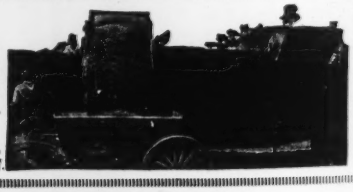
Western Wheeled Scraper Company
Earth and Stone Moving Machinery
Aurora, Illinois



The Solution of the Labor Problem
Haiss "Self-Propelled" Wagon Loader
1c per cu.yd. 1 cu.yd. per min.
Write for Catalog
The Geo. Haiss Mfg. Co.
140 St. and Rider Ave.
New York City

RAMAPO
Ramapo Iron Works
HILLBURN, NEW YORK

Haul ⅓ More
Load your wagon with
Rapid Loaders
and keep the teams moving.
Circular has all details—write for it now.
The Bonney Supply Co., Inc.
114 Livingston Bldg., Rochester, N. Y.



BACON ∖ FARREL
ORE & ROCK
CRUSHING ∖ WORLD KNOWN
ROLLS-CRUSHERS
EARLE C. BACON, ENGINEER
HAVEMEYER BUILDING, NEW YORK

Erie Tandem Rollers
built by
Erie Machine Shops
Erie, Penna.
Cataiogue on request.

ALLEGHENY STEEL COMPANY

The Allegheny Steel Company, located at Brackenridge, Pa., is using in general yard shifting, one 16 in. x 24 in. engine built by the American Locomotive Company.

Over a 4 per cent. grade, this engine handles six 15-ton slag cars.

AMERICAN LOCOMOTIVE COMPANY

30 CHURCH STREET, NEW YORK

McCormick Building, Chicago, Illinois — A. Baldwin & Company, New Orleans, La.
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N. B. Livermore & Company, Merchants' National Bank Building, San Francisco, Cal.
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Steam and Compressed Air Locomotives

for all services, Reliable, Sturdy, Economical

Contractors' Dinkeys

Write us for printed matter covering the entire field

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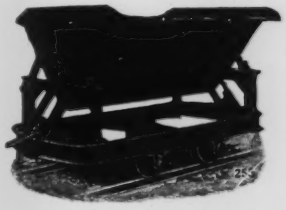
EASTON CARS



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Catalog.

EASTON CAR AND CONSTRUCTION CO.
12 Center Square, Easton, Pa.

60-Cent Ad Pulls Choice of 2 Positions

Advertiser gets good place through Searchlight Ad

He says:

"I want to express my satisfaction at results obtained from the insertion of 'Positions Wanted' ad in your 'Searchlight Department.'

"I received 5 replies which resulted in 2 definite offers, one of which I have now accepted."

Have YOU tried the Searchlight?

83

YOUR JOURNEY'S END

If you are in the market for a small locomotive. That opportunity to tell you why the Bell should be your locomotive cannot but result in mutual appreciation. Today is a good time to write.

BELL LOCOMOTIVE WORKS, Inc.
30 Church St., New York City

STANDARD

Asphalt Macadam Binders B *and* C

(SOCONY BRAND)

For building bituminous macadam roads by the penetration or the mixing method. Meet every phase of road construction.

Standard Asphalt Binder A, for surface treatment
Standard Refined Mexican Asphalt, for sheet and asphalt paving
Standard Asphalt Joint Fillers, for brick or block pavement
Standard Asphalt Road Oils
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Standard Bridge Asphalt and Preserving Oil

Specifications and all other particulars furnished on request

Standard Oil Company of New York

SO SOCONY ASPHALTS AND ROAD OILS

Road Oil Dept. 26 Broadway New York

Reduce the dead load in concrete from 15 to 30% by using

Blast Furnace Slag Aggregate

It develops a higher compressive strength than stone or gravel, is fire resistive, repair free and practically everlasting.

Address inquiries to

Carnegie Steel Company

464 Frick Building Annex, Pittsburgh, Pa.

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CAREY

Elastite EXPANSION JOINT

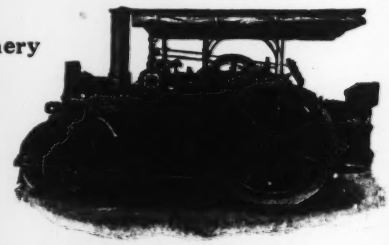
The original and only Elastite Joint

Comes to the job ready for use. No joints to pour. No spacing strips to remove.
Used in National and Dixie Highways.
For sample and complete information address

The Philip Carey Co.
18 Wayne Ave., Lockland, Cincinnati, O.

Quality Machinery

Buffalo Pitts Rollers



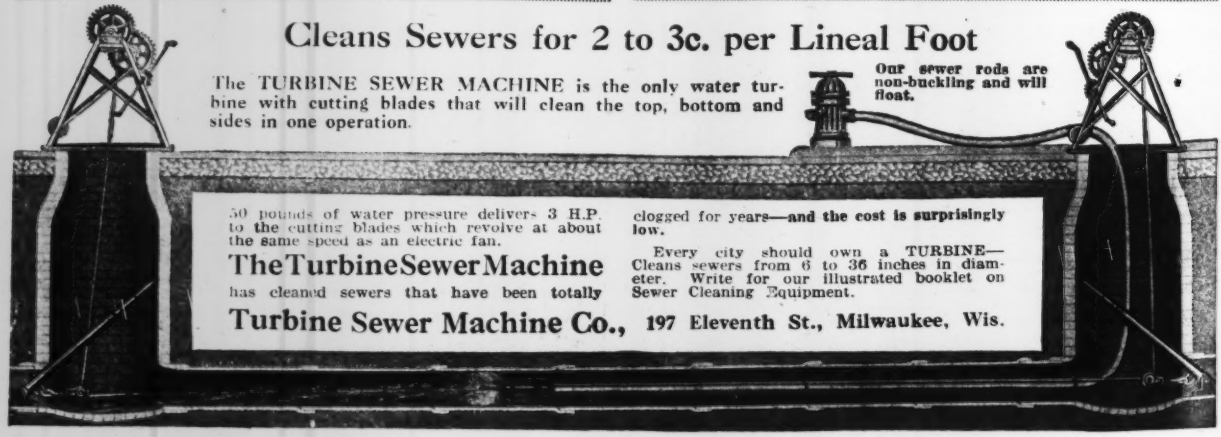
are purchased by discriminating buyers because of the many years of satisfactory service which they will render, the low repair costs and their general reliability. *All sizes—all types—write for catalogue.*

Built Only by
THE BUFFALO-SPRINGFIELD ROLLER COMPANY
SPRINGFIELD, OHIO

Cleans Sewers for 2 to 3c. per Lineal Foot

The TURBINE SEWER MACHINE is the only water turbine with cutting blades that will clean the top, bottom and sides in one operation.

Our sewer rods are non-buckling and will float.



50 pounds of water pressure delivers 3 H.P. to the cutting blades which revolve at about the same speed as an electric fan.

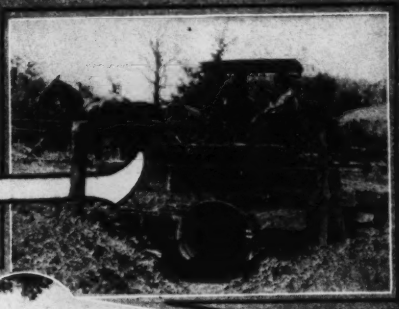
The Turbine Sewer Machine

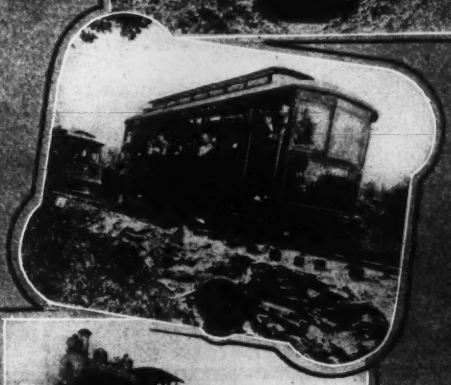
has cleaned sewers that have been totally clogged for years—**and the cost is surprisingly low.**

Every city should own a TURBINE—Cleans sewers from 6 to 36 inches in diameter. Write for our illustrated booklet on Sewer Cleaning Equipment.

Turbine Sewer Machine Co., 197 Eleventh St., Milwaukee, Wis.

EVERYWHERE





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Made of
Galvanized Anti-Corrosive NO-CO-RO METAL

Proven By Service

These culverts can be installed by you with every assurance that the 99.90% pure NO-CO-RO METAL will last indefinitely.

Thousands of feet of "ACMES" installed more than ten years ago are still in perfect condition. Millions of feet are now in service under railroads and highways in all parts of the country, in fact in all parts of the world. A large percentage of our present business is reorders from satisfied customers.

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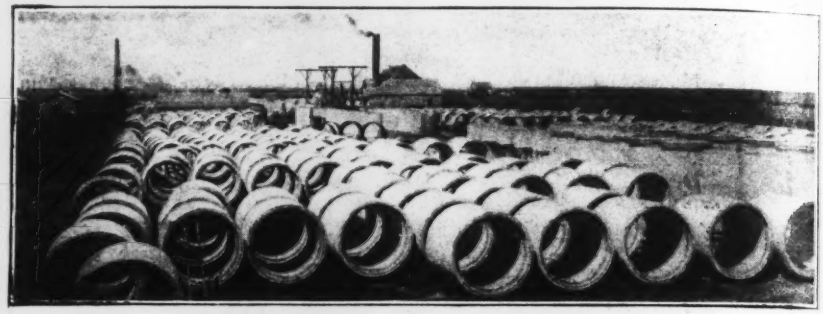
These are secured by the Nestable feature, since *box cars* loaded to capacity *in weight* can be used for all sizes of "ACMES," yet "ACMES" will be shipped in full circle form if desired.

One Man Installation

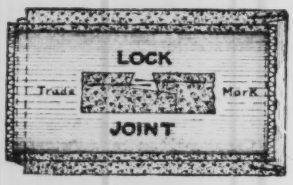
One man can load, unload and install all usual sizes of "ACMES" in any length, and two men can handle any size, even the huge 72-inch, 10-gauge Culvert.

A line brings Catalog 24

"ACME" NESTABLE CORRUGATED CULVERTS



Pipe Made Where Laid, Using Home Labor and Materials



Let Us Build As We Fought

This country has done its part in bringing to a close the most colossal war in history. Every section put aside peace-time progress and hustled to beat the Hun.

Now we face a readjustment period. We must bring business back to normal channels with the least possible friction. We must distribute labor and capital.

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We ask engineers, city officials and contractors to let us furnish estimates. Write today for your copy of our new illustrated book telling of our work.

Standard sizes—24 to 48 inches Sewer Pipe in stock for immediate shipment.

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Canada: Lock Joint Pipe, Ltd., Winnipeg, Canada

Pacific Lock Joint Pipe Co., Seattle, Washington

Concrete Pipe

For Sewers, Water-Works, etc.

Standard Cement Pipe, 6 in. to 24 in. inclusive. Machine made—bell and spigot pattern, 2½-ft. lengths.

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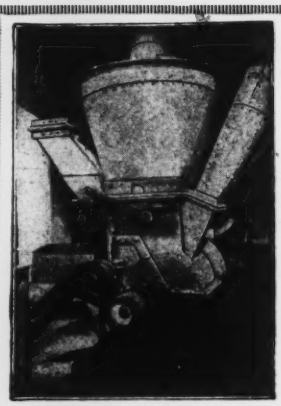

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Established 1881
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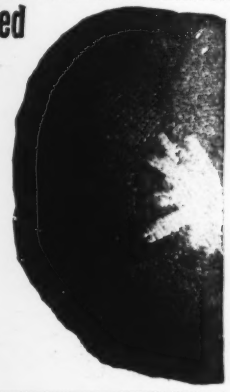
Main Office: 30 East 42d Street, New York



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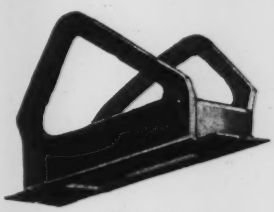

Truscon Adjustable Insert

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Truscon Inserts

for attaching shaft hangers, fixtures, etc., in concrete buildings, eliminate expensive drilling into concrete. Their adjustability allows location of shafting and fixtures to be changed as desired.

Truscon Adjustable Inserts and Truscon Tapped Inserts are made of pressed steel, to carry ½ in., ⅝ in. and ¾ in. bolts. Truscon Slotted Inserts are made to carry ⅝ in. or ¾ in. bolts.

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(Formerly Trussed Concrete Steel Co.)
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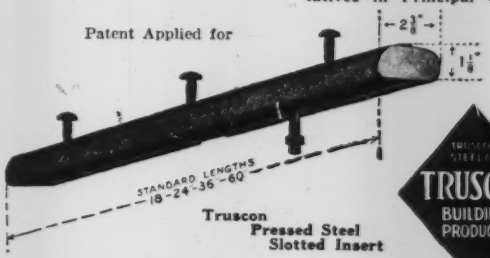

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The Waterloo Bar Bending Machine

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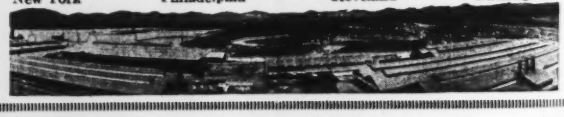

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Reaches Inaccessible Places.
Forced-feed paints crevices and corners

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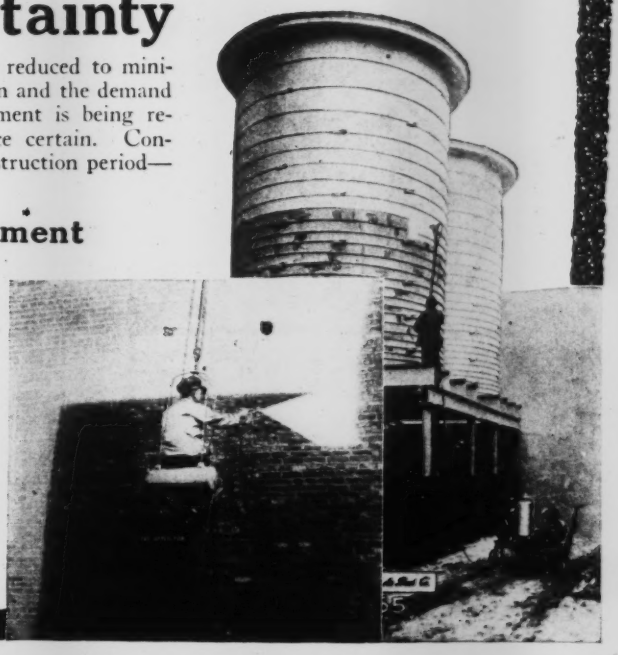

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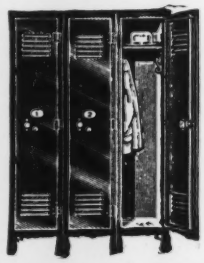

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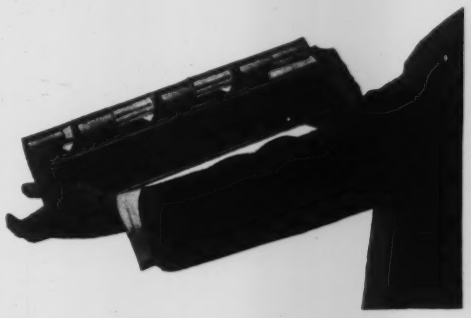

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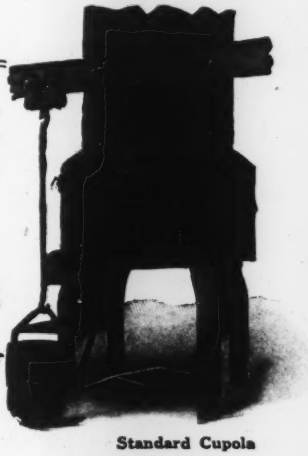

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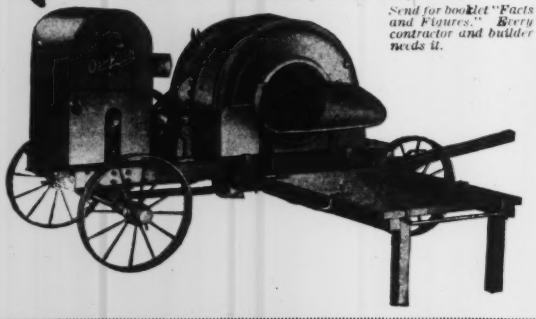
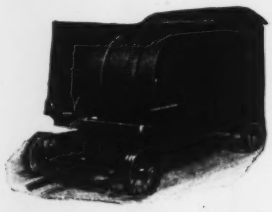


"THE STANDARD" Mixers Are Low Charging



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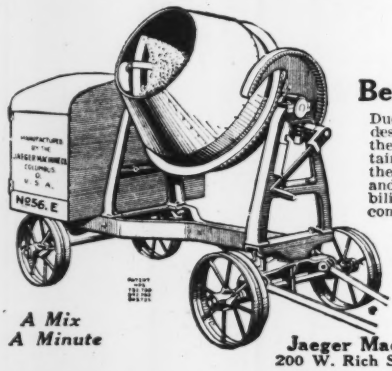

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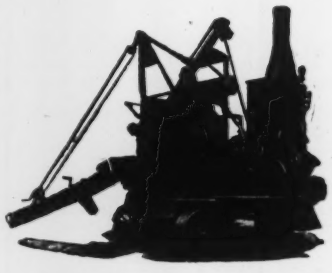
Foote Paving Mixers



"The Repeat Order Mixer"

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NUNDA, N. Y.

WITH proper precautions concrete work can be successfully carried on during cold weather

Our pamphlet "Concreting in Winter" sent *free* on request.

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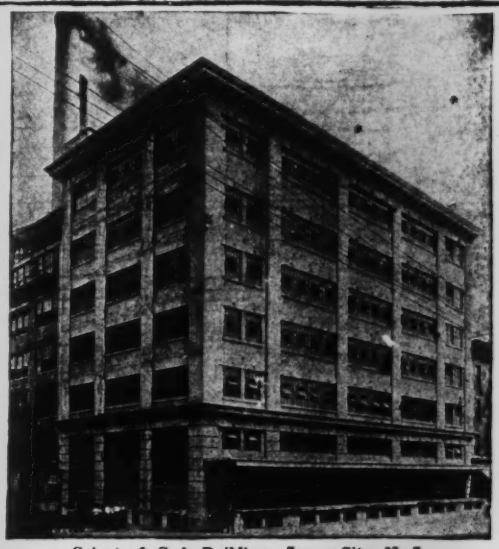

Colgate & Co.'s Building—Jersey City, N. J.
Warren Davey, Engr.—Turner Const. Co., Contractors

THE concrete floor of the shipping platform at the Colgate building is hardened with "ANTI-HYDRO."

Over this floor, which is exposed to the weather, passes a continuous stream of shipping-boxes, crates and hand trucks.

It is on work of this kind that "ANTI-HYDRO" is especially valuable, because of the *permanency* of the results it produces.

Whenever you have a concrete job to harden or waterproof—use "ANTI-HYDRO." It does both in one operation—and with a saving in time and money.

"ANTI-HYDRO" is a liquid compound and mixes readily with the gauging water. No extra work or additional labor required

Consult us on your next job. Engineers have been doing it for fourteen years.

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WATERPROOFING CO.
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THE beauty of concrete is that its ease of handling and economy make its use possible on the smallest and most unimportant work, while its attractive appearance and permanence make it also desirable for work of the greatest importance.

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Established 1845
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Business Established 1832

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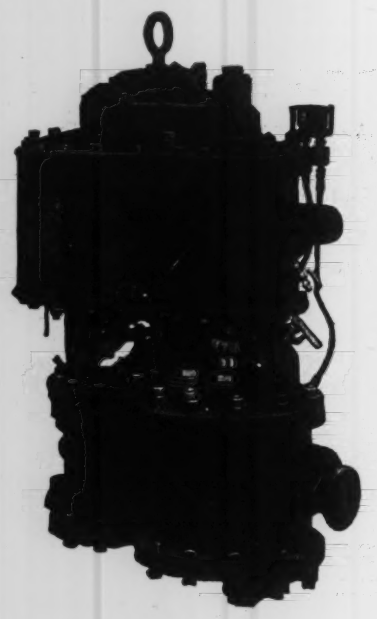
PORTLAND CEMENT

In Successful Use Nearly a Third-Century

Book on request showing uses and testimonials

"Concrete for Permanence"



Simplicity Durability Compactness

These are the reasons, combined with those of low first cost and maintenance, why six Westinghouse 10½-inch Cross Compound Air Compressors displaced a like number of complicated, expensive machines on a recent "hurry-up" marine job, thereby saving hundreds of dollars and weeks of valuable time. See Publication No. 9033.

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NORWALK Air and Gas COMPRESSORS

When we have completed Uncle Sam's program which requires our utmost energy right now *we will gladly serve you.*

Literature on request

The Norwalk Iron Works Co.
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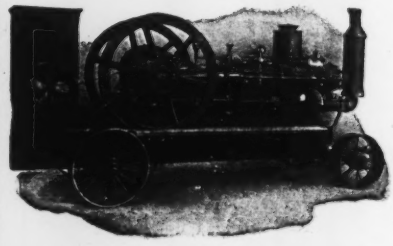
PORTABLE AIR COMPRESSOR



The tank mounted Chicago Pneumatic Gasoline Engine Driven Compressor brings the air to the job, at very low cost. Is direct connected, automatically regulated, self-contained and has independent cooling system. Can also be furnished to operate on Gas or Fuel Oil and can be furnished skid mounted if desired for semi-portable work.

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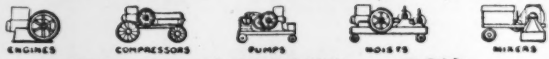

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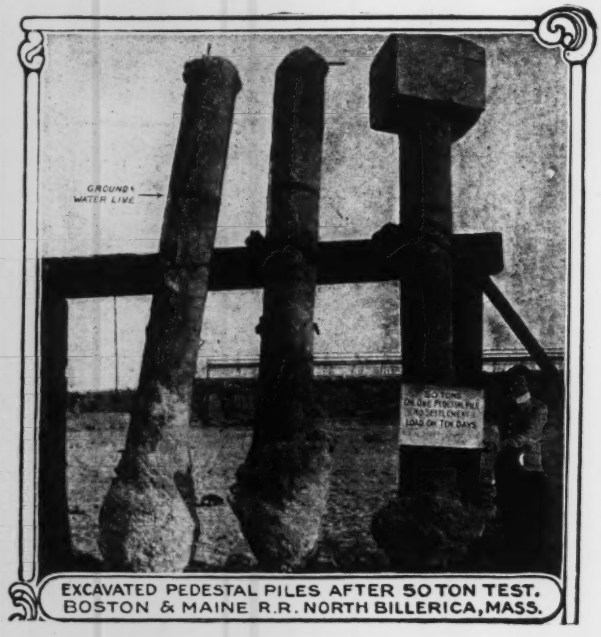

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MacARTHUR PEDESTAL PILE

This picture tells the story.

Note particularly the sturdy shafts of the excavated MacARTHUR PILES—clean, perfectly shaped columns—and the big Spread Base which provides the increased bearing area necessary for distributing the excess load.

MacARTHUR PEDESTAL PILES have been uncovered in all parts of this country and Canada after driving in all kinds of soils. **The Shaft and Pedestal have ALWAYS been found in perfect condition.**

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DOUBLE DUTY
Pile Hammers

Drive—
Then Pull

After the sheet piling has done its work—*pull it with the same* DOUBLE-DUTY *Pile Hammer.*

The sheeting will come out in 2 or 3 minutes and *it will be left in perfect condition.*

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By actual test it only requires 44 pounds effort to lift the same load that would require 47 pounds on the ordinary shovel.

The shoveler will lift more each time and lift it oftener—do more *work without knowing it.*

Try Conneaut Shovels with your shoveling gang for thirty days, and if they do not move more material per day and if you do not consider the shovels worth the price, send us a check for whatever you think they are worth and we will receipt you in full.

Your Friends,

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CONNEAUT, O.

"I have used shovels, studied them, and sold them in every kind of mine, quarry, mill or yard in this continent and I honestly believe this (Mikkola Patent) is the best all around shovel of all the types we make."

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There is exactly the same weight of material in each shovel yet look at the difference on the scales.

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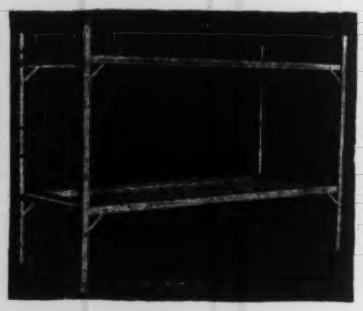
The hand does not get down further than this curve in the handle. Takes more strength to lift the same material.

Conneaut Special

The scale is placed at the place where the hand naturall falls —at the curve in the handle.

CONNEAUT SPECIAL SHOVELS



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Street Grader—
Ditch and Cellar Digger
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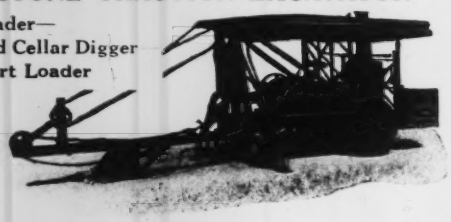

al combined in one general utility machine for contractors. It is light enough (weighs 10 tons) to cross culverts nd small bridges safely; self-moving over steep and hilly roads; easily operated and low priced. Descriptive Bulletin on request. Handles three kinds of Scoops: Dipper, for side hill excavation; Ditcher, for trenches, and Skimmer, here illustrated, for road grading. Economically lifts 6 incl. cut, leaving finished surface, any desired slope, within half circle 32 ft. in diam. Capacity 300 to 400 cu.y d. per day.

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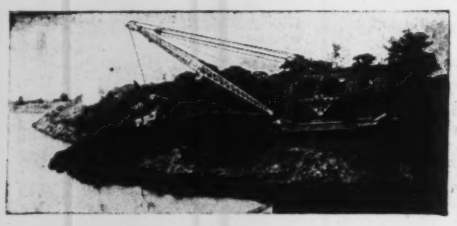

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LATEST DESIGNS Orders filled day received
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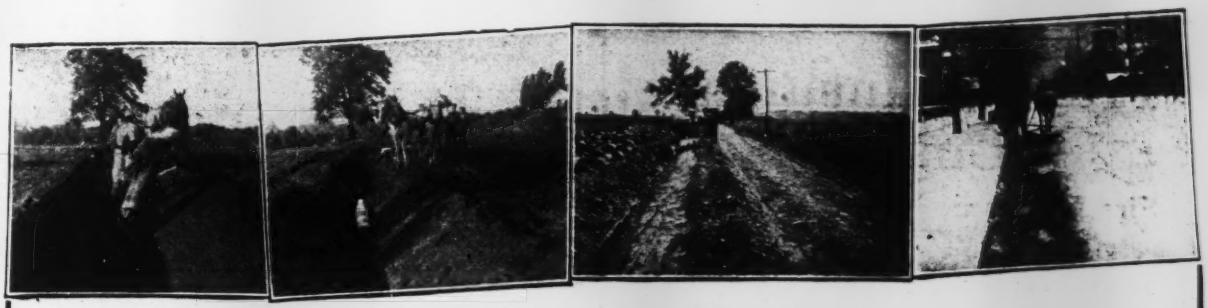

The Model 20—latest improved MARTIN with clogless hitch—Reversible and Adjustable—All Steel.

Sold on 10 Days Trial

You Can Do More Tricks With THE Martin

any season of the year, than with any other piece of equipment you own. No matter whether you're an **individual** or a **city.**

Every year more cities are buying Martins—in batteries—to take care of the snow in the streets during the winter. Street car companies use them for keeping the track clear of snow.

After streets are opened up with the Martin—they are ready for the big thaw. And when it comes—the city's walks and streets are drained nice and dry in one-fourth the time, and nobody gets wet feet! For a wise city administration looks after the health of the public.

Winter ended—put the Martins to work building streets and roads, digging ditches, spreading and leveling soil—any one of fifty different uses—and all this in one compact all-steel low-priced little machine—the Martin.

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Perfect Trench 28 in. x 6 ft. in one cut.

Note the clean-cut trench through coarse gravel and hard pan cut by the Buckeye Excavator at the rate of one and one-half to three minutes per foot. Mr. Charles A. Windholz, Superintendent, Bureau of Water, Syracuse, N. Y., says the

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One BUCKEYE will replace 100 men with hand shovels and save 90% of their cost.

Hard clay, gumbo, rock and boulders, even concrete and macadam roads make "ordinary" digging for the BUCKEYE.

Write today for details—ask for list of Buckeye users in your locality.

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Against damage or loss by high winds and tornadoes.

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Inherent hazards of production processes and bomb explosion plots of cranks, enemy sympathizers and propagandists.

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*The Insurance Company of North America, now approaching its 127th year and strengthened financially and in experience because of its long service to the property owners of the Nation with which it has "grown up," is fully equipped to meet the complex needs of the hour.

Check off the forms indicated above, in which you are interested most and call in the local agent of the Company. There are more than 10,000 of them in the United States, Canada and Cuba.

Insurance Company of
NORTH AMERICA
Philadelphia
Oldest American Stock Insurance Company
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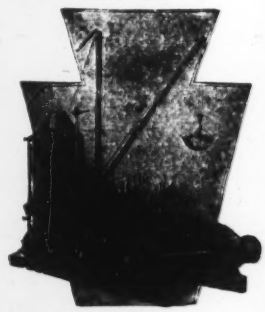
Select the FLORY HOIST

because it **saves time—saves labor** and **keeps production at the top notch.** Three things that are vital now. Select it because it stands the "extra strain" so often encountered in contracting work.



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Leschen Wire Ropes and Aerial Wire Rope Tramways
Are Dependable at all Times,—Even Under Bad Conditions

In business since 1857
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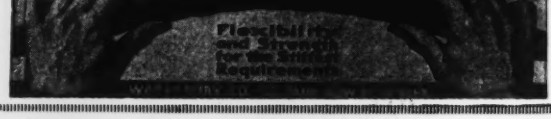

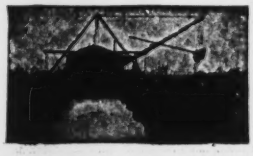

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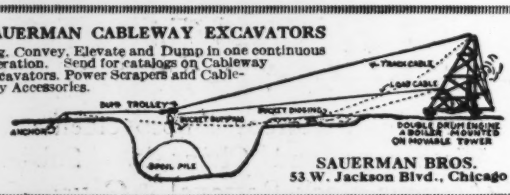
Spans the cut. Built any width. Steel construction. Two men can operate. Equipped with oil engine. Ideal for clean out work.
Write for details.
Bay City Dredge Works
2601 Center Ave. Bay City, Mich.

SAUERMAN CABLEWAY EXCAVATORS
Dig, Convey, Elevate and Dump in one continuous operation. Send for catalogs on Cableway Excavators, Power Scrapers and Cableway Accessories.



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We Sub-Contract Trench Work
by lineal foot for Sewers, Water Mains, Gas Lines, Conduits and Street Railway Trenching.
General Engrg. & Const. Co.
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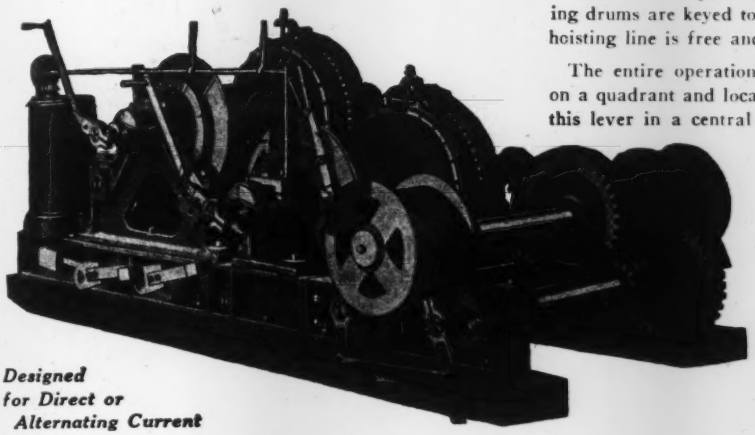


Designed for Direct or Alternating Current

Orr & Sembower

Double Friction-Drum Electric Hoist, with Boom Swinging Attachment.

This is our Improved Double Friction-Drum Electric Hoist. Its swinging drums are keyed to a front jack shaft and are so separated that each hoisting line is free and clear.

The entire operation is controlled by a *single latched lever* mounted on a quadrant and located within easy reach of the operator. By placing this lever in a central position both swinging drums are out of contact and are stationary.

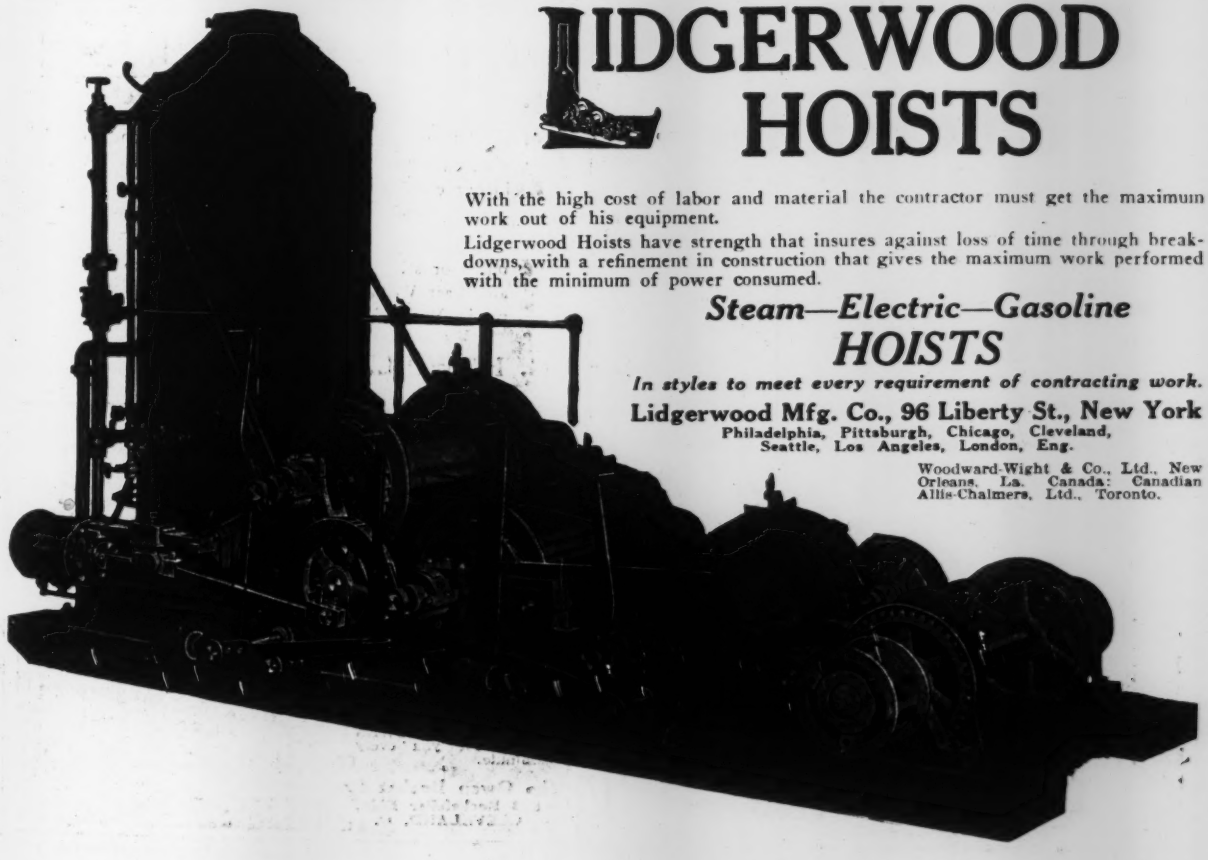
When thrown forward the swinging line is wound up on one drum and unwound from the other. When the lever is thrown backward the reverse takes place. Thus one lever controls the swinging of the boom in either direction.

There are many other interesting points worth investigating. May we not mail you full details?

Write for Bulletin 138

Orr & Sembower, Inc.
Orrton, Reading, Pa.
48 Church Street, New York
206 North Clinton Street, Chicago
1008 Commonwealth Building, Philadelphia

LIDGERWOOD HOISTS



With the high cost of labor and material the contractor must get the maximum work out of his equipment.

Lidgerwood Hoists have strength that insures against loss of time through breakdowns, with a refinement in construction that gives the maximum work performed with the minimum of power consumed.

Steam—Electric—Gasoline HOISTS

In styles to meet every requirement of contracting work.

Lidgerwood Mfg. Co., 96 Liberty St., New York
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Woodward-Wight & Co., Ltd., New Orleans, La. Canada: Canadian Allis-Chalmers, Ltd., Toronto.

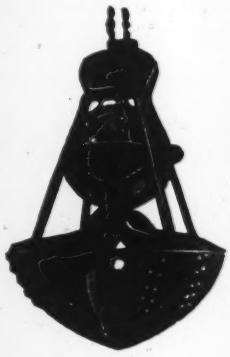
Single Closing Sheave Orange Peel Dredging and Excavating Bucket

The construction of this bucket is most substantial, being made of homogeneous steel plate of 60,000 pounds tensile strain. Bearings are steel bushed, removable and easily replaced.

The four blades which form the main body of bucket are made extra heavy, with (Hardened steel points riveted to shell, which insures easy penetration and can quickly be replaced.)

The lower casting on crosshead is made of cast steel, and likewise the top casting which receives the arms. The arms are made of heavy forged iron and steel bushed.

All sizes in stock for immediate shipment. We build buckets of all types.



VULCAN IRON WORKS, Inc.
Jersey City, N. J., U. S. A.
Formerly THEO. SMITH & SONS CO. Buckets

Buffalo Buckets

Why you should use Buffalo Buckets

Reason No. 1—Because they possess the Buffalo Equalizer, which makes both lips travel with equal speed and power.

Reason No. 2—The equalizer absorbs the shock.

Reason No. 3—Nothing functions below the main shaft.

Reason No. 4—Sheaves and cable are never in contact with the material and are thus protected from undue wear.

Reason No. 5—The power arm bearing makes less than ½ in. turn on the main pin. The wear on these vital parts is entirely eliminated.

Reason No. 6—Has extra large hinge pin.

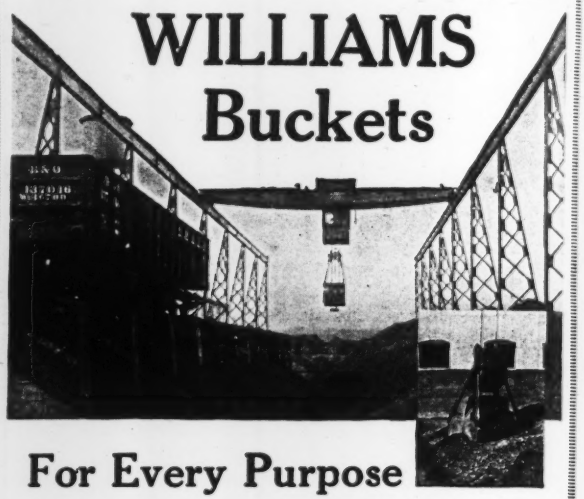
Reason No. 7—The massive bearings maintain permanent alignment of scoops.

Makers of the famous Buffalo Tractocranes

Look for other reasons in next week's ad.

Buffalo Hoist & Derrick Co.
Buffalo, New York
New York office, 30 Church Street.
C. E. Forsythe, Mgr.

WILLIAMS Buckets



For Every Purpose

No matter what your conditions, what your special requirements, we can meet them and to your entire satisfaction. If there isn't a bucket in our catalog that will do it, we'll build one.

The world over you will find **Williams Buckets** doing the unusual. Why? They are built for stiff, durable service. "Built to Dig and Last While Digging" is the better way to put it. **Write for full details.**

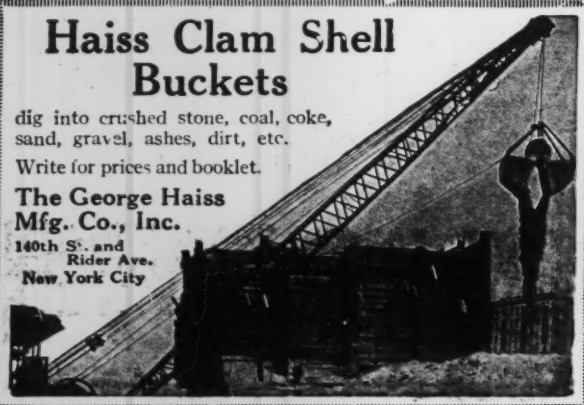
G. H. WILLIAMS CO., Erie, Pa.

Haiss Clam Shell Buckets

dig into crushed stone, coal, coke, sand, gravel, ashes, dirt, etc.

Write for prices and booklet.

The George Haiss Mfg. Co., Inc.
140th St. and Rider Ave.
New York City



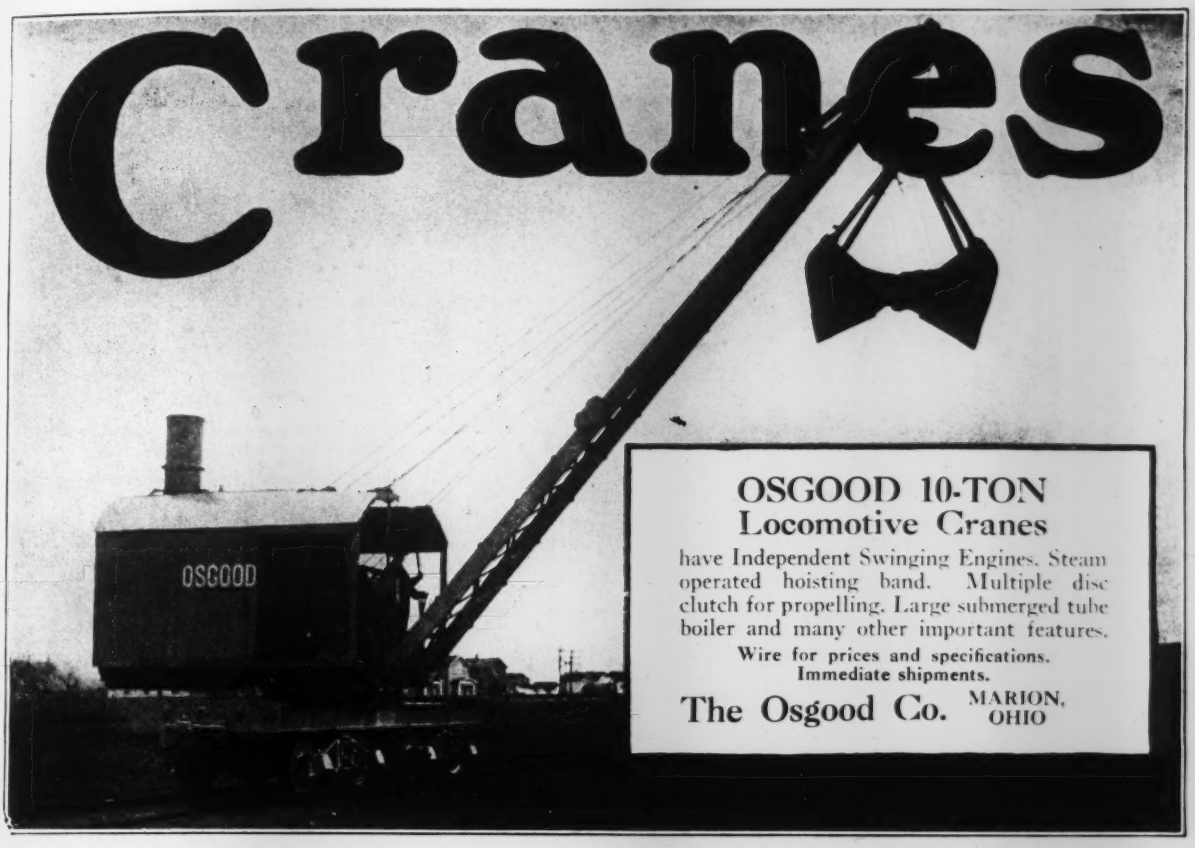
OWEN BUCKETS

cover a range of work that ordinarily requires the use of two or more buckets of different design because its adjustable features of operation quickly adapts it for efficient use on any crane or derrick and in all kinds of materials.

Eliminate idle equipment. Let the OWEN work for you every minute.

The Owen Bucket Co.
533 Rockefeller Bldg.
CLEVELAND, O.

Cranes



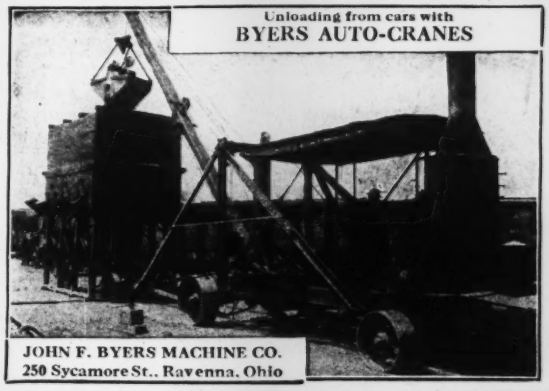
OSGOOD 10-TON Locomotive Cranes

have Independent Swinging Engines. Steam operated hoisting band. Multiple disc clutch for propelling. Large submerged tube boiler and many other important features.

Wire for prices and specifications.
Immediate shipments.

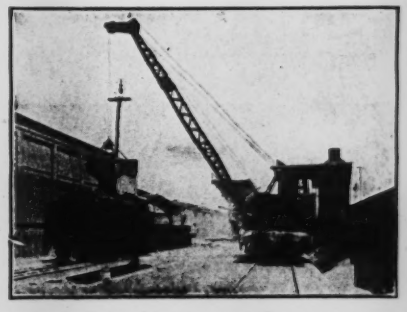
The Osgood Co. MARION, OHIO

Unloading from cars with
BYERS AUTO-CRANES



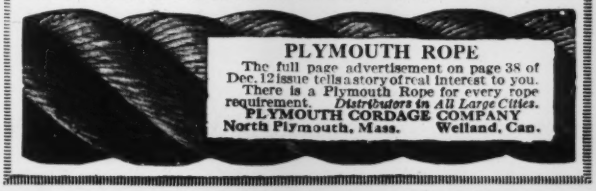
JOHN F. BYERS MACHINE CO.
250 Sycamore St., Ravenna, Ohio

——In difficult work the——
O. S. Locomotive Cranes and Buckets
Insure satisfaction.



Correct Design
Right Material
Superior Fabrication

Orton & Steinbrenner Co.
CHICAGO, ILL.



PLYMOUTH ROPE
The full page advertisement on page 38 of Dec. 12 issue tells a story of real interest to you. There is a Plymouth Rope for every rope requirement. *Distributors in All Large Cities.*
PLYMOUTH CORDAGE COMPANY
North Plymouth, Mass. Welland, Can.

OHIO
LOCOMOTIVE CRANES
OHIO LOCOMOTIVE CRANE CO.
MANSFIELD ST. BUCYRUS, OHIO

ROEBLING WIRE ROPE

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.
Agencies and Branches:—New York, Boston, Chicago, Philadelphia, Pittsburgh, Cleveland, Atlanta, San Francisco, Los Angeles, Seattle, Portland, Ore.

Crescent Wire Rope
Geo. C. Moon Co. Garwood, New Jersey

Designed for Permanent Equipment

DRAVO WHIRLERS are built to give years of reliable service on the hardest kind of lifting, loading and pile driving met in contracting or storage yard work.

They have been so used for 15 years.

All parts subjected to heavy strains are either steel forgings or steel castings.

Engines are specially designed to respond quickly, and stand up under the most trying conditions.

Each Dravo Whirler constructed for contracting work can be dismantled and re-erected easily.

Write for full particulars stating your requirements.

THE DRAVO CONTRACTING CO., *Engineering Works Dept.*
DRAVO-DOYLE CO.
DIAMOND BANK BUILDING, PITTSBURGH, PA.

Branches
Philadelphia Cleveland
Indianapolis Chicago

Pacific Coast Representatives
Hamilton & Hansell
Rialto Bldg., San Francisco, Cal.

DRAVO WHIRLER for Contractors

DELTA
(Trade Mark)

HAND AND ELECTRIC TRAVELING CRANES WALL AND JIB CRANES TROLLEYS AND HOISTS

New Jersey Foundry & Machine Co.
138 Cedar St., New York

DEPENDABLE CRANES FOR MAGNET WORK

Industrial Works Cranes

Steam, Electric, Gasoline
5 to 160 Tons Capacity

INDUSTRIAL WORKS
BAY CITY, MICH.

HAYWARD

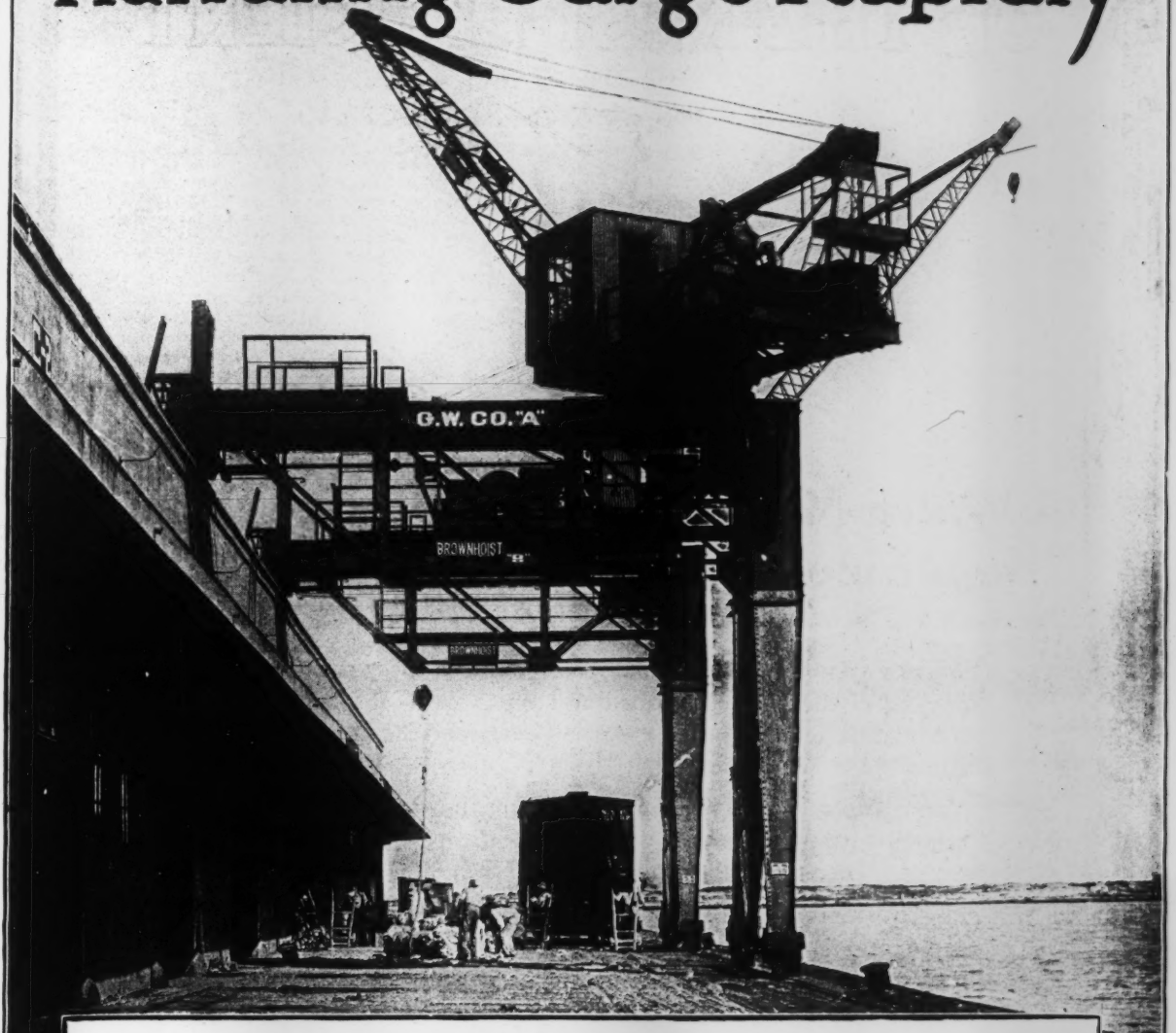
Orange Peel Buckets—the fruition of thirty-five years' experience in building better buckets. Three- or four-sided types with or without cut-off blades. Ask for Catalog 43. 2453-Y

The Hayward Co., 48-50 Church St., New York

BUCKETS

ADEN
Grab Buckets
Send for new catalog
The Advance Engineering Company
Cleveland, O.

Handling Cargo Rapidly



Ships Clear in Less Than 24 Hours

Here is shown the first installation of its kind in this country—a dock equipped with cargo handling cranes. The Galveston Wharf Co. is using these 2 Brownhoist Wharf Cranes for unloading steel billets, sisal, bagging, etc. Last fall, a vessel arrived at 9 A. M., commenced to unload at 10 and was cleared at 12.30 that night. This is three to four times as fast as it formerly required.

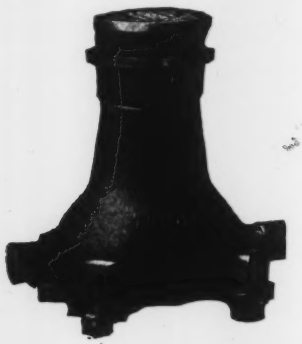
And by using Brownhoist Cranes the operators are assured of continuous operation—no delays due to the cranes. The Brownhoist may cost more, but is worth it.

The Brown Hoisting Machinery Co., Cleveland, O.

Engineers and Manufacturers of Heavy Dock Machinery, Bridge Cranes, etc., as well as smaller Cranes and Hoists
Branch Offices in New York, Pittsburgh, Chicago and San Francisco

BROWNHOIST

WE PRESENT THE CASE OF THE MOST-EFFICIENT



A Water Meter for Every Service Would Be a Fine Xmas Present for Your City

What a wonderful forward step it would be for your city if the coming of the Holiday season and the New Year could witness the installation of a water meter on every service in your municipality!

You cannot have real efficiency in any water distributing system without meters.

Perhaps you already appreciate this, but are wondering what kind of water meter will give most lasting service and all around satisfaction.

The experience of hundreds of water works in every part of the country points out the Trident Meter as the selection that you ought to make, if you are thinking of the future rather than studying how to save a few dollars at the start by picking out the lowest price that is quoted you.

If you would like to receive our house organ on Water Meters, send us your name and we will put you on our mailing list.

NEPTUNE METER COMPANY

Manufacturers of Trident Water Meters and the Weber Subterranean Pump

50 East 42nd Street, New York City

BRANCHES:

Chicago Boston San Francisco Atlanta Los Angeles Portland Cincinnati Seattle

SIMPLEX METERS

LEAKS COST MONEY

Do you know your water consumption? Can you tell *accurately* just how much water leaves your reservoir every day? Unless you can answer these questions satisfactorily you can't tell how much money you are losing on account of leaky pipe joints, fixtures, etc.

The SIMPLEX METER REGISTER will give you an accurate, dependable record of all the water passing through the pipes.

Simple, accurate and convenient to read.

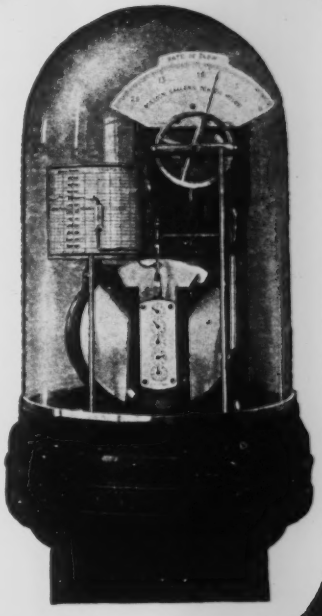
Practically frictionless in operation. A patented specially shaped float resting on mercury rises and falls in exact proportion to the rate of flow. The movement is transmitted directly to the pen arm without intervening gears, levers, links, etc., to cause friction or lost motion.

This sensitive action responds quickly to the smallest increments in the rate of flow and consequently enables the use of a Venturi tube with the largest permissible throat.

This means decreased friction and reduced pumping cost.

This is why SIMPLEX METERS are so popular among engineers intimately familiar with Venturi practice.

Bulletin No. 113 gives full details. Write for your copy.



SIMPLEX VALVE & METER COMPANY
425 WOOD STREET, PHILADELPHIA, PA.

New England Representative—Geo. W. Stetson, 141 Milk Street, Boston, Mass. Pacific Coast Representative—Water Works Supply Co., San Francisco and Los Angeles. Canadian Representatives—Francis Hankin & Co., Montreal, Toronto and Vancouver.

NEW YORK CHICAGO
Keystone Arctic
Keystone Compound
Eureka Utility
COLUMBIA, S. C. KANSAS CITY

Water Meters

Pittsburgh Meter Co.
East Pittsburgh, Pa.
LOS ANGELES SEATTLE

VENTURI METERS

Indicate, Register and Record Water, Brine, Oil, Gas, Air, Steam and Other Fluid Flow
Write for Bulletin No. 84N.
BUILDERS IRON FOUNDRY, PROVIDENCE, R.I.

KENNEDY VALVES

for handling water, gas, oil, steam, etc. For high pressures and low. Prompt shipment from stock.

THE KENNEDY VALVE MFG. CO., ELMIRA, N.Y.
81 John Street, New York — French Savings Bank Bldg., San Francisco

Sluice Gates
Gate Valves
Butterfly Valves
Fire Hydrants

Cottin Valve Co.
BOSTON, MASS.
Makers of the Largest Sluice and Gate Valves in America.

Check Valves
Flap Valves
Foot Valves
Sewer Gates

Hydraulically, Electrically and Hand Operated Gate Valves and Sluice Gates
For Waterworks, Power Plants and Filtration Systems
Write for Catalog

"COREY" FIRE HYDRANTS

Valve Boxes Indicator Posts Air Valves

"RENSSELAER" VALVES

All Sizes All Pressures All Purposes

Rensselaer Valve Co., General Offices, Troy, N. Y.
New York, Hudson Terminal, Church St. Chicago, Monadnock Block
Pittsburgh, Oliver Building Seattle, Colman Building
New England, Chas. L. Brown, Northboro, Mass.

Sell—Exchange—Rent

Some one is probably looking for those items you want to sell. The same person may have just the things you want to buy.

Let the Searchlight help YOU

53

SLUICE GATES, CHECK VALVES, INDICATOR POSTS, ETC.

GATE VALVES **EDDY** OUR LINE FIRE HYDRANTS

Hydraulically and Electrically-Operated Valves and Sluice Gates Valves Designed for all Kinds of Service.

EDDY VALVE COMPANY, WATERFORD, N. Y.
New York Chicago Boston San Francisco Philadelphia

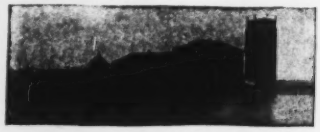
MICHIGAN PRODUCTS

Fire Hydrants	Shear Valves
Gate Valves	Tide Valves
Sluice Gates	Sleeve Valves
Check Valves	Indicator Posts
Foot Valves	Valve Boxes

Flower-Stephens Mfg. Company
107 Parkinson St., Detroit, Michigan

Any Apparatus Necessary for Pure Water

The PITTSBURGH line includes gravity and pressure filters, water-softening plants, coagulant and sterilizing apparatus, and filter plant equipment.



Purifying plants suitable for municipalities, factories, ice plants, breweries, laundries, etc.

Each plant designed specially to meet the local conditions. Write for data.

PITTSBURGH FILTER MFG. CO.
PITTSBURGH, PA.
CHICAGO KANSAS CITY

Conserve coal — develop your waterpower
AMBURSEN DAMS
Simplify difficult foundation problems
Six now under contract
Ranging from $9000 to $1,200,000
Lowest cost. Quickest to build. Highest safety factor.
Our organization has constructed over 100 dams.
Highest yet built 150 feet. Lowest yet built 6 feet.
Longest yet built 1995 feet. Shortest yet built 82 feet.
Submit your problems to us without obligation.
Ambursen Construction Company, Inc.
61 Broadway, New York 10 High Street, Boston
Owners of Ambursen, Church, Coburn and Whitehead patents.

WATER SOFTENING AND FILTRATION PLANTS
AMERICAN WATER SOFTENER COMPANY
1009 CHESTNUT ST. PHILADELPHIA, PA.
No affiliation or working agreement with any of our competitors

SLUICE GATES
Shear, Flap and Butterfly Valves
FLEXIBLE JOINTS
COLDWELL-WILCOX CO
NEW WINDSOR NEWBURGH N.Y.

Hungerford & Terry, Inc.
Water Filters and Softeners
Purification of water for technical and industrial purposes.
1110 Pennsylvania Building, Philadelphia, Pa.

Clean Water Mains
Deliver Full Capacity
We are glad to confer with municipal officials or Water Companies.
National Methods are patented
National Water Main Cleaning Company,

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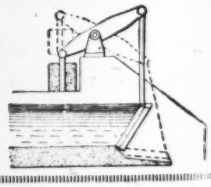
WATER SOFTENING AND FILTRATION PLANTS
INTERNATIONAL FILTER CO.
30 South Dearborn St., Chicago
New York Office: Woolworth Building

Roberts Filter Mfg. Co.
Darby, Penna.
WATER FILTERS for Municipal and Industrial Plants. Gravity and Pressure Types.
CHEMICAL DEVICES

BEST RESULTS BY NUMEROUS AMERICAN AND EUROPEAN INSTALLATIONS

AUTOMATIC GATES
American patents controlled by the owners, BARRAGES AUTOMATIQUES S.A., ZURICH, SWITZERLAND
FARGO ENGINEERING CO., JACKSON, MICH.
Eastern American Representative
Agents wanted in the Western States.

FOR THE CONTROL OF WATER LEVEL — MANY STYLES



GRAVITY PRESSURE

FILTERS

Water Softening Plants
Hypochlorite Apparatus

and all Sorts of Chemical Feeding Devices

Over 400 Municipal Filtration Plants Installed—Total Daily Capacity 1,000,000,000 Gallons

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THE NEW YORK CONTINENTAL JEWELL FILTRATION COMPANY
15 BROAD STREET, NEW YORK

Inter-State Building, Kansas City, Mo.; 111 W. Monroe St. Chicago, Ill.; New Birks Building, Montreal.

Originators of Mechanical Filtration

Mechanical Filtration Plants

Municipal and Industrial Purposes
Gravity and Pressure Types
Re-filtration Systems
for Natatoriums

The "Holyoke" Fire Hydrant

FOR TOWNS, CITIES AND FACTORIES

One of the Oldest
One of the Best

IN USE OVER 35 YEARS

It will pay you to send us your inquiries

Norwood Engineering Company
Florence, Mass., U. S. A.

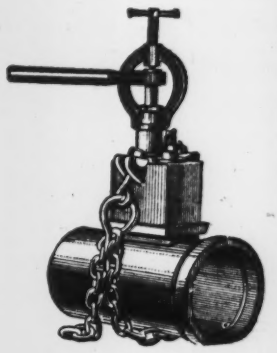
Easily Carried By One Man

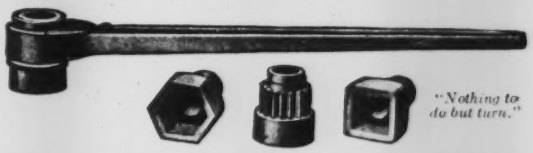
This light, durable machine will be sent on approval for 30 days' trial. If not as represented, send it back.

Corporation Tapping Machine

Write for latest bulletins of this and other water-works appliances.

The A. P. Smith Mfg. Co.
East Orange, N. J.





"Nothing to do but turn."

***Your* need for LOWELL Reversible Ratchet Wrenches is urgent**

If you can use the safest, surest and quickest ratchet wrench on the market—A wrench particularly adapted for use on bridge work or other jobs where nuts have to be seated or removed in a cramped space—

Send for Catalog R which gives the full story of the Lowell Reversible Ratchet Wrench, TODAY.

LOWELL WRENCH CO., 50 Commercial St., Worcester, Mass.

Tycos Temperature Instruments
INDICATING - RECORDING - CONTROLLING

Demand **Tycos** on the instrument you install, the service delivered will be complete. The experience of many users sustain us in this claim. Let us send information—a request incurs no obligation.

Taylor Instrument Companies ROCHESTER, N.Y.

WOODWARD WATERWHEEL GOVERNORS

Built in All Types and Sizes from the Smallest to the Largest

Woodward Governor Company
208 Mill Street **Rockford, Illinois**

Nicholas Engel

JOHN FOX & CO.

Cast-Iron Water, Gas and Flange Pipe, Special Castings, Fire Hydrants, Valves, General Foundry and Machine Work.

253 BROADWAY **NEW YORK CITY**

Warren Foundry & Machine Company

Manufacturers of

CAST IRON PIPE
SPECIAL CASTINGS

Bell and Spigot—Flanged—Flexible Joint—Culvert—Tubes. Milled and Plain Ends — Cylinders — Manhole Heads and Covers—High-Pressure Fire Service Pipe—All Sizes.

Sales Offices: Bowling Green Bldg., New York Wks.: Phillipsburg, N. J. 201 Devonshire Street, Boston, Mass.

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Marion Shoes for Wood Pipe

This Mark on a Casting—

Marion malleable iron, offering great resistance to shock, having high elastic limit, resisting oxidation, wears better, is free from slag holes, shrinkage cracks, etc., and is not subject to fatigue or crystallization. —means that it's made of

Malleable iron castings for every purpose.

The Marion Malleable Iron Works
Marion, Indiana

WHY DON'T YOU USE
Wyckoff Wood Pipe
OTHERS DO

Over 1000 miles of Wyckoff Wood Pipe have been installed in the last three years. It can be furnished and laid at half the cost of cast iron.

IT LASTS AS LONG.

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ELMIRA N. Y.
378 Piedmont Ave., Atlanta, Ga.
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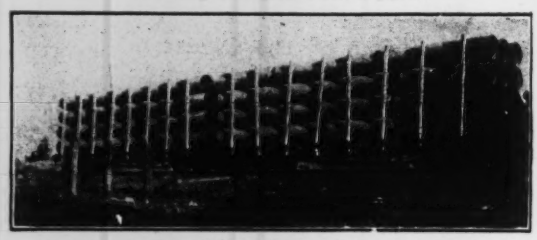
551 West 14th Place, Chicago, Ill.

Wire Wound and Continuous Stave Wood Pipe for IRRIGATION and Water Systems. Asbestos and tin-lined Cedar Casings for insulating underground steam pipes.



30-in. Wire Wound Pipe for U. S. Reclamation Service

AMERICAN WOOD PIPE CO.
TACOMA WASHINGTON, U. S. A

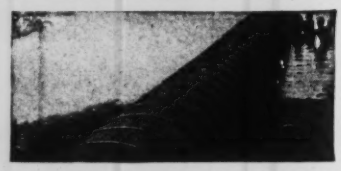
CONTINENTAL
WOOD STAVE PIPE

Our engineering staff is maintained for your convenience

CONTINENTAL PIPE MFG. CO.
SEATTLE, U. S. A.
Eastern Office: Woolworth Bldg., New York City

SUCCESSORS TO

Pacific Coast Pipe Co. Seattle
Portland Wood Pipe Co. Portland
National Tank & Pipe Co. (Pipe Dept. only) Portland
Washington Pipe & Fdy. Co. Tacoma



Wood Water Pipe

We build machine banded and with individual rods and lugs stave water pipe, from 2" up to 48" for various pressures. Write for our catalogue. It tells you all.

Standard Wood Pipe Co.
Williamsport, Penna.

Dredge Pipe

PONTOON AND SHORE
Elbows, Branches, Ball Joints, Valves, Steel Pontoons
MACHOLD & RIDDELL, Stephen Girard Building PHILADELPHIA, PA.

Foster Superheaters

Increase capacity of boilers, give more power with less fuel, and prevent all loss and trouble due to wet steam.

Power Specialty Co. **111 Broadway, N. Y.**

R. D. Wood & Co., 400 Chestnut Street Philadelphia, Pa.

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HYDRAULIC CRANES, PRESSES, LIFTS, ETC.

Turbines and Water Power Pumps, Sugar House Work, Gas Holders and Gas Machinery, Gas Power Plants with Producers, Mathews' Single and Double Valve Fire Hydrants, Gate Valves, Valve Indicator Posts, Cutting-in Specials.

All Kinds and Sizes of CAST IRON PIPE

ROOT

Spiral Riveted Pipe—
Pipe Specialists for 48 years.
Abendroth & Root Mfg. Co.
Works: Newburgh, N. Y.
N. Y. Office: 233 Broadway

AMERICAN CAST IRON PIPE COMPANY

MANUFACTURERS OF

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Columbus, Ohio—607 New Hayden Bldg.
Minneapolis, Minn.—712 Plymouth Bldg.
New York City—No. 1 Broadway.
Chicago, Ill.—512 1st Nat. Bk. Bldg.
Dallas, Tex.—1217 Praetorian Bldg.
Kansas City, Mo.—716 Scarrit Bldg.
San Francisco, Cal.—711 Balboa Bldg.

LOW COST to Buy, to Transport, to Lay, to Pump Water Through—NO COST TO MAINTAIN!
These points proved by more than 40 years' service under all conditions. ***Send for New Michigan Pipe Data Book.***

THE MICHIGAN PIPE CO., Dept. 17, BAY CITY, MICHIGAN

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New York, 30 E. 42nd St. Oklahoma City, 711 Majestic Bldg. T. A. Morrison & Co., 204 St. James St., Montreal, Quebec, Canada.

"Steel for Strength—Wood for Durability"

No Packing
No Calking
No Gaskets

PIPE AND JOINT ARE ONE

Wrenches the only Equipment

UNIVERSAL CAST IRON PIPE

Can Be Laid Anywhere—at Any Time—Under Any Conditions.
For Every Service.

THE CENTRAL FOUNDRY COMPANY
U-2 3 90 WEST STREET, NEW YORK
Chicago Atlanta Dallas San Francisco Kansas City, Mo.

THE FIRST CAST IRON PIPE EVER MADE IN THE WORLD'S HISTORY IS STILL IN SERVICE • MORE THAN 250 YEARS OLD •
SERVICE CAST IRON PIPE MEASURED BY CAST IRON PIPE CENTURIES

The Cast Iron Pipe Publicity Bureau
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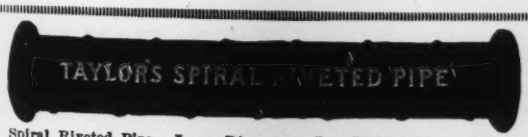
THE ECONOMY OF
TRADE MARK
"Leadite"
Registered U. S. Pat. Office

for jointing water mains is due to the fact that it does four times the work of lead at about half the cost, makes a joint that eliminates the possibility of leakage, and can be installed by common labor, since it needs no caulking.

Write for full particulars and reports of tests.

THE LEADITE CO., Inc.
1232 Land Title Bldg., Philadelphia
British Representative:
H. S. Dickinson, 42 Union St., Bradford, Yorks, Eng.

CAST IRON PIPE
of all descriptions for Water, Gas, Sewerage, Drains, Culverts, etc. Also Flanged Pipe, Flexible Joint Pipe, Special Castings, Large Cylinders and Heavy Castings.
Let us quote on your next requirements
UNITED STATES CAST IRON PIPE & FOUNDRY CO.
706 E. Pearl St., Burlington, New Jersey



Spiral Riveted Pipe. Large Diameter. Lap Welded Pipe. Forged Steel Pipe Flanges. Flexible Ball Joints. Send for Catalog
AMERICAN SPIRAL PIPE WORKS
50 Church St., New York Main Office and Works; CHICAGO, Box 485

Economy

LOCK BAR STEEL PIPE

Saves ⅓ of metal. It can be made lighter—and yet have the same strength as double riveted pipe—because—the lock Bar 100% strength develops the *full strength* of the plate.

Lock Bar Steel Pipe saves *labor costs* because of the *rapidity* with which its 30-*foot lengths* can be laid.

It Saves Money!

EAST JERSEY PIPE CORPORATION
50 CHURCH ST. NEW YORK

"Turnkey Jobs"

Our service is *Complete* as our organization includes Engineers, Field Construction Forces and Factory Facilities which *puts the burden of getting results on us*—Hence the Guarantee

"Water, or No Pay"

We Write It In the Contract

Write today for Information and Free Literature

Layne & Bowler Company

"World's Largest Water Developers"

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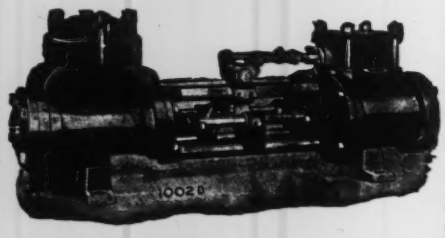

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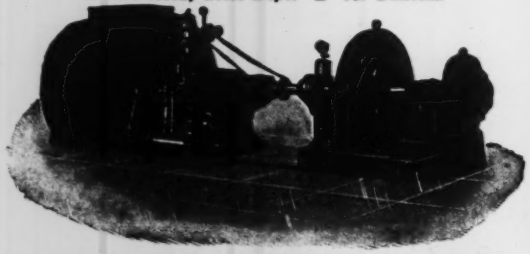

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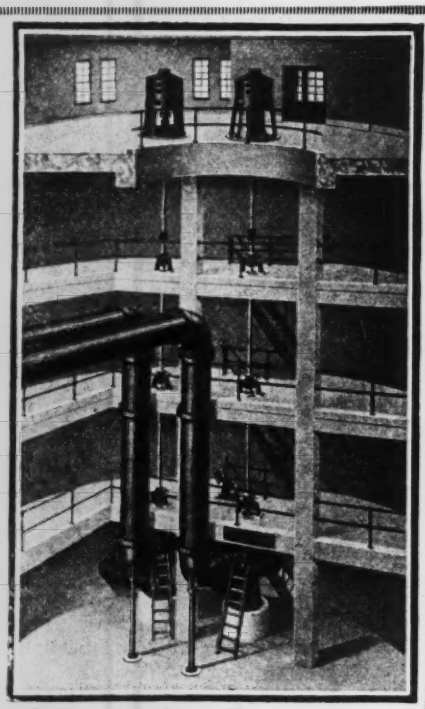

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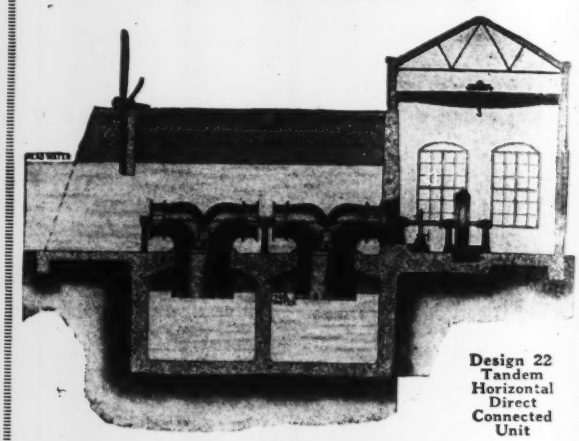

Design 22 Tandem Horizontal Direct Connected Unit

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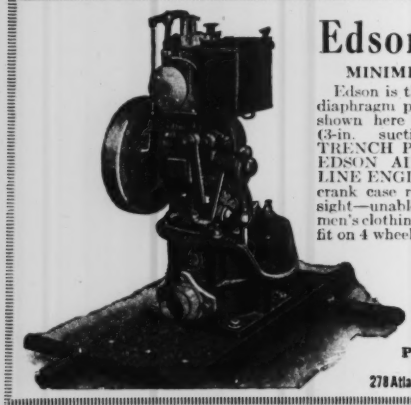

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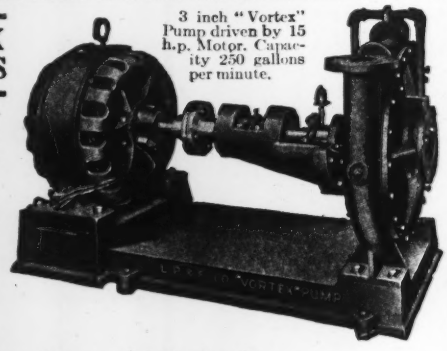

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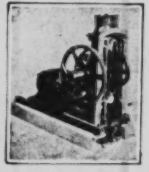

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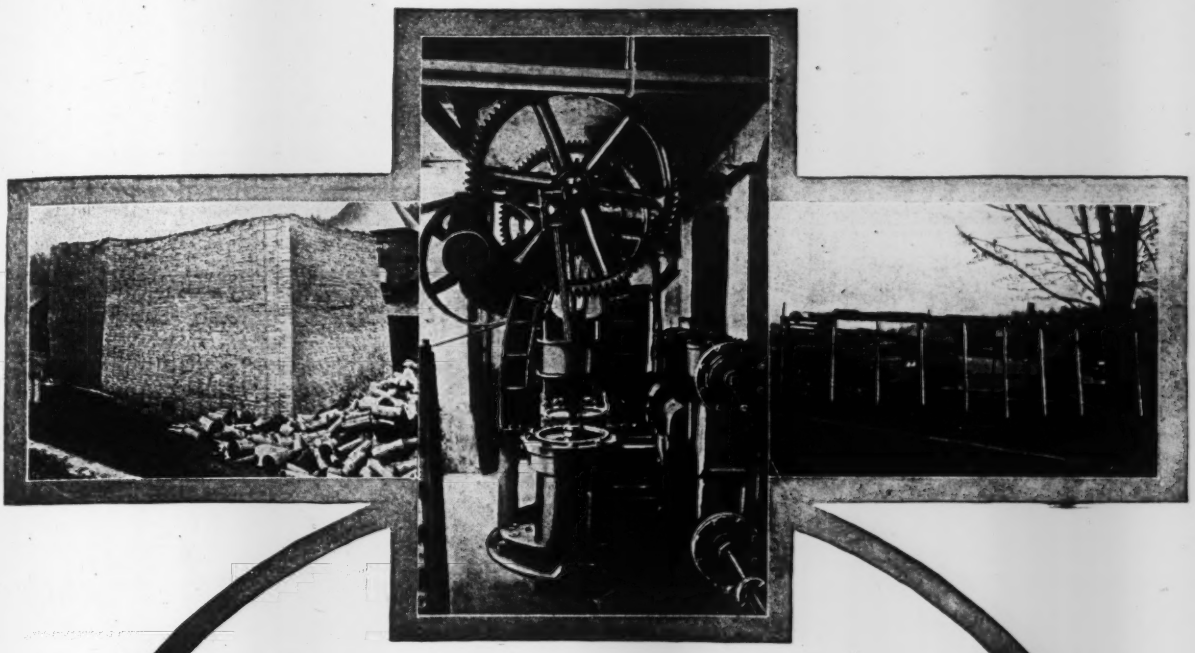

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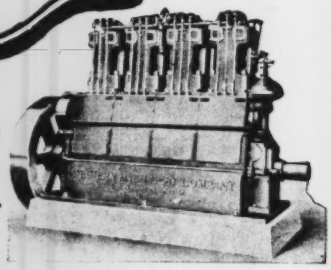

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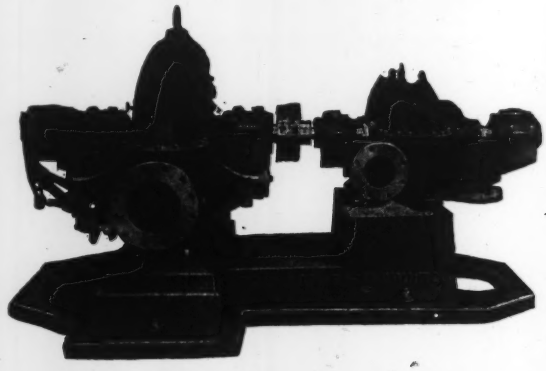

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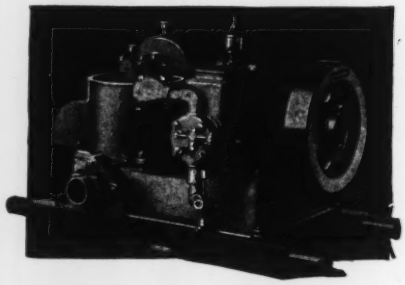

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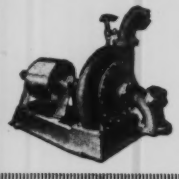

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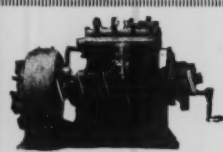

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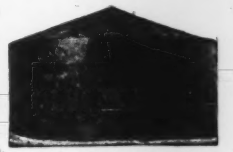

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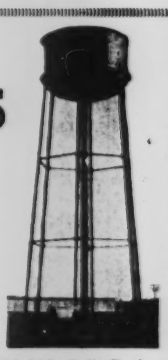

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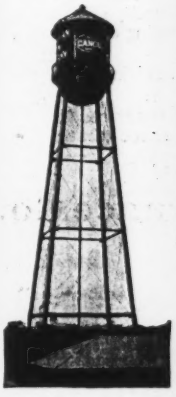

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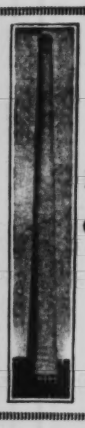

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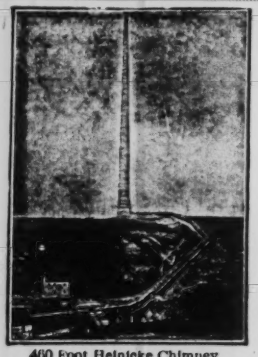

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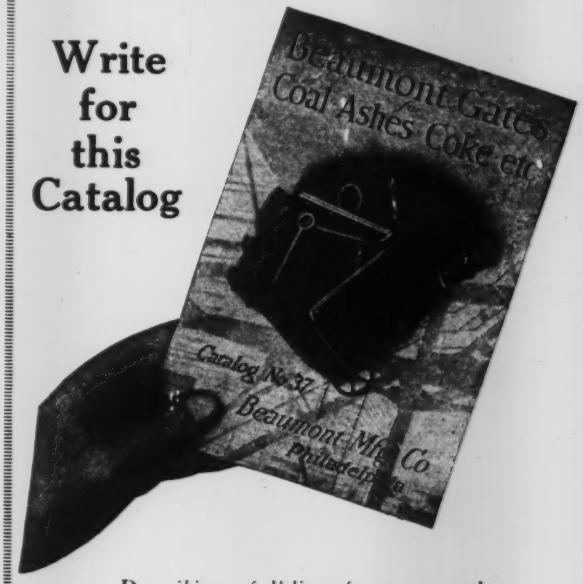

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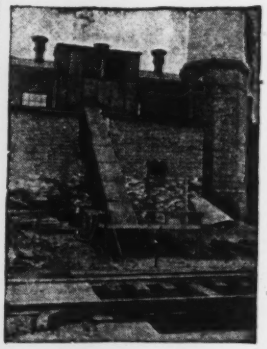

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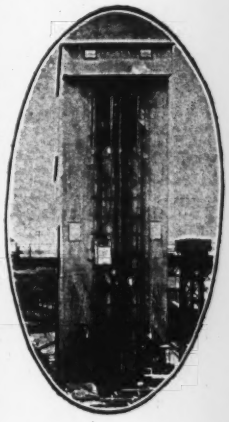

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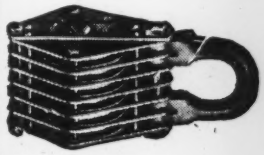

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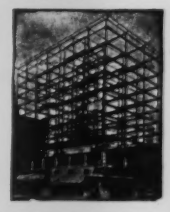
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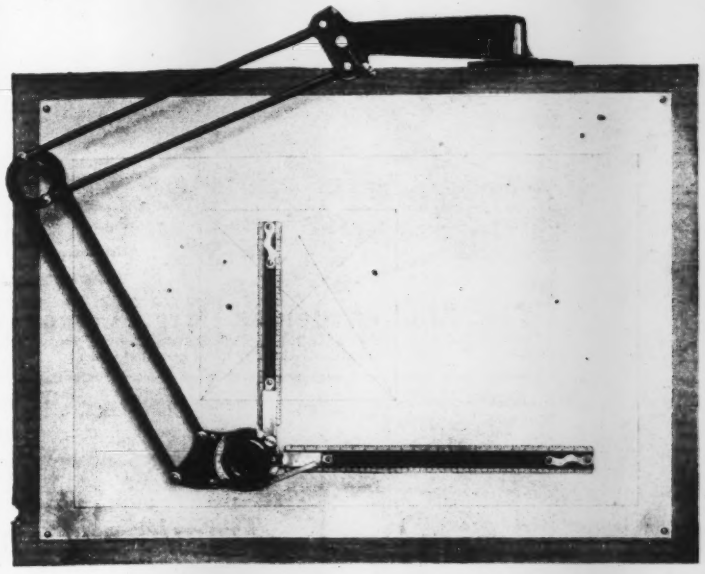

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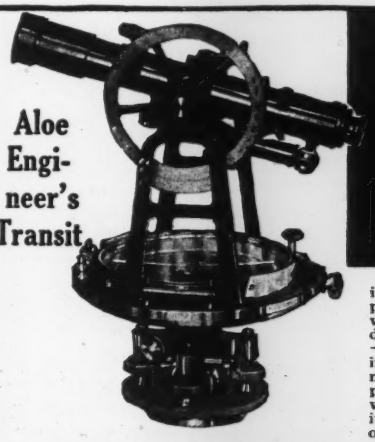

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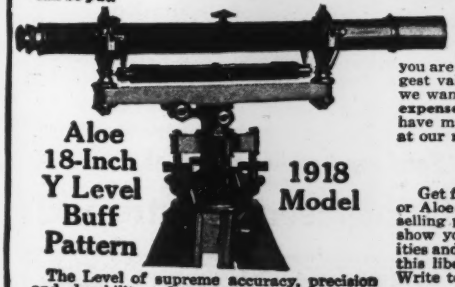

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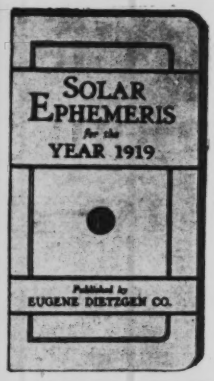

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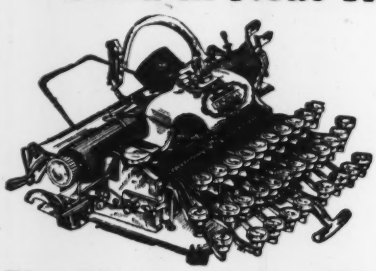

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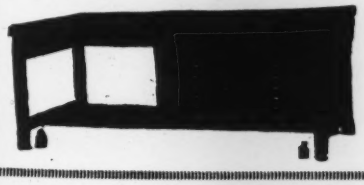

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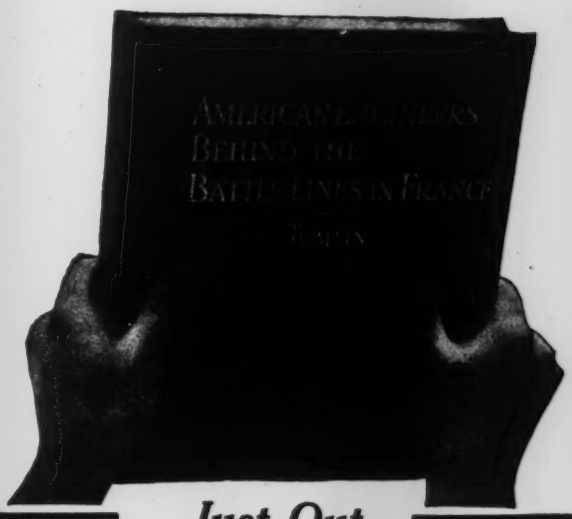

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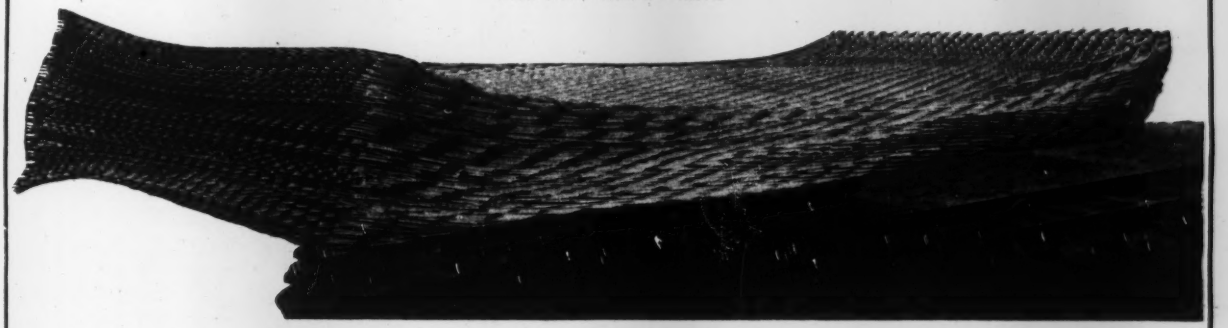

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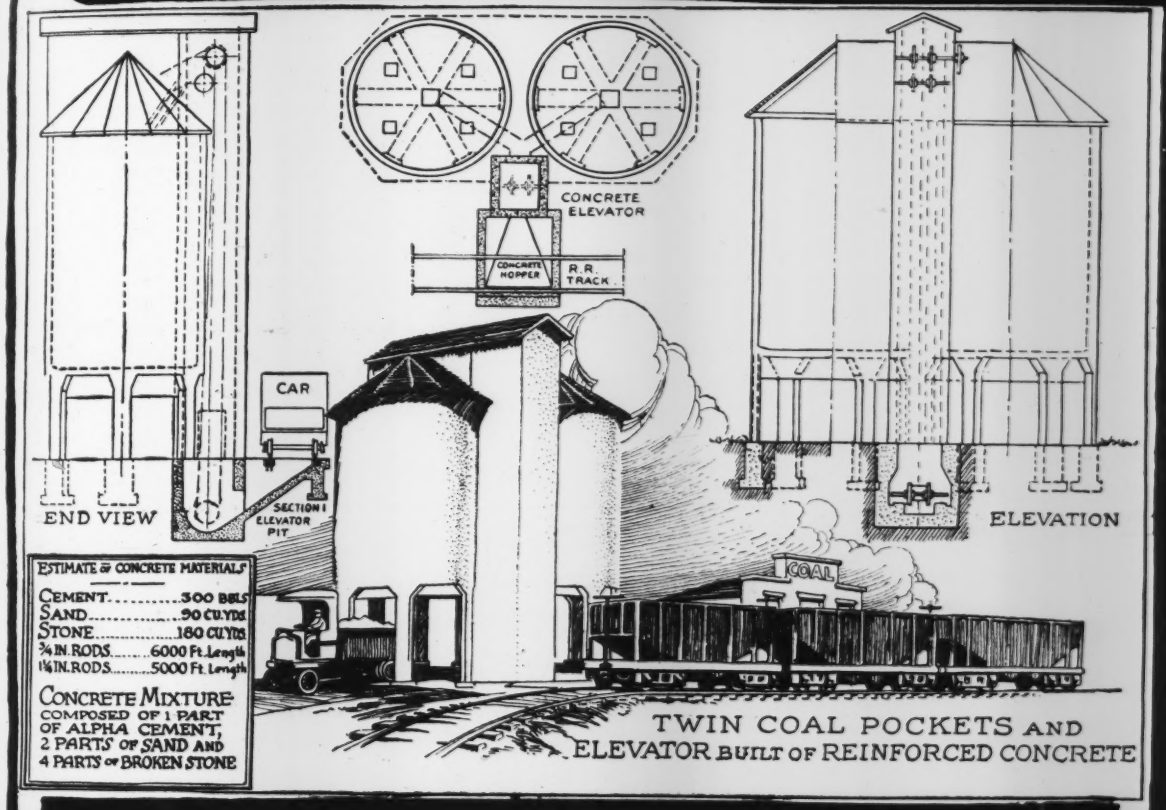

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Insulators, Cleat Type Switchboard

Insurance
Insurance Co. of North America

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Christopher & Simpson Iron Works
Irving Iron Works
Snead Architectural Iron Works

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McKiernan-Terry Drill Co.
Norton, Inc., A. O.

Joints, Expansion Copper
Badger & Sons, E. B.

Joints, Expansion, Paving
Barrett Co., The
Carey Co., Philip
Truscon Steel Co.

Joint Filler, Paving
Barrett Co., The
Standard Oil Co. of N. Y.

Joints, Flexible Pipe
Central Fdry. Co., The
U. S. Cast Iron Pipe & Foundry Co.

Kilns, Lime
Petroleum Iron Works Co.

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General Electric Co.

Lamps, Flood
General Electric Co.

Lead Pencils
Dixon Crucible Co., Jos.

Leadite
Leadite Co., Inc., The

Lighting Plant
Universal Motor Co.

Lights, Contractors'
Carbic Mfg. Co.
General Electric Co.
Milburn Co., Alex.

Loaders, Wagon
(See Wagon Loaders.)

Lockers, Steel
Edwards Mfg. Co., The

Locomotives, Compressed Air
Porter & Co., H. K.
Vulcan Iron Works of Wilkes-Barre, Pa.

Locomotives, Electric
American Locomotive Co.
Jeffrey Mfg. Co., The
Lakewood Eng'g. Co.

Locomotives, Fireless Steam
Porter Co., H. K.

Locomotives, Gasoline
Bell Locomotive Wks., Inc.
Vulcan Iron Works of Wilkes-Barre, Pa.

Locomotives, Steam
American Locomotive Co.
Bell Locomotive Works
Davenport Locomotive Wks.
Porter Co., H. K.
Vulcan Iron Works of Wilkes-Barre, Pa.

Lubricants
Dixon Crucible Co., Joseph

Lumber
Pearson & Ludascher Lumber Co., Inc.

Manhole Covers
Central Fdry. Co., The
Sessions Foundry Co.

Manometers
Simplex Valve & Meter Co

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Chicago Perforating Co.

Meter Boxes
Cast Iron Pipe Pub. Bureau.
Pittsburgh Meter Co.

Meter Provers
Pittsburgh Meter Co.

Meters, Boiler Feed Water
Builders Iron Foundry Co.

Meters, Current
General Electric Co.
Gurley, W. & L. E.

Meters, Gas and Steam
Builders Iron Foundry Co.
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Meters, Water, Oil, Etc.
General Electric Co.
Neptune Meter Co.
Pittsburgh Meter Co.
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(See Mixers, Hot)

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Blaw-Knox Co.
Cement-Gun Co.
Jaeger Mch. Co.
Foote Concrete Mchry. Co.
Jaeger Mch. Co.
Knickerbocker Co., The.
Lakewood Engrg. Co.
Oshkosh Mfg. Co.
Pneumatic Conc. Mch. Co.
Ransome Conc. Mchy. Co.
Schramm and Son, Inc., Chris. D.
Standard Scale & Supply Co.
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Oshkosh Mfg. Co.

Mixers, Hot
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Koehring Mch. Co

Mixers, Mortar
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C. H. & E. Mfg. Co.
Jaeger Mch. Co.
Lakewood Engineering Co.
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Koehring Mch. Co.
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Mixers, Pneumatic
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Dixon Crucible Co., Joseph
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Foundation Co., The
Lackawanna Steel Co.

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Builders Iron Foundry Co.
Cast Iron Pipe Pub. Bureau.
Central Foundry Co., The
Fox & Co., John
U. S. Cast Iron Pipe & Foundry Co.
Van Nouhuys Mach. Wks.
Warren Fdry. & Mach. Co.

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Carey Co., Philip
Wyckoff & Sons Co., A.

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Michigan Pipe Co.
Standard Wood Pipe Co.

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Machold & Riddell

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Central Foundry Co., The
Cast Iron Pipe Pub. Bureau.
U. S. Cast Iron Pipe and Foundry Co.
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Wood & Co., R. D.

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Leadite Co., Inc., The

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Hudson Cement & Supply Co.

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Pipe, Lock Bar
East Jersey Pipe Corp.

Pipe Lugs
Marion Malleable Iron Wks.

Pipe, Reinforced Concrete
Lock Joint Pipe Co.

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East Jersey Pipe Corp.
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Continental Pipe Mfg. Co.
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Cameron Steam Pump Works, A. S.
Dean Bros. Steam Pump Wks.
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Cameron Steam Pump Works, A. S.
De Laval Steam Turbine Co.
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Goulds Mfg. Co.
Lawrence Pump & Eng. Co.
Layne & Bowler Co.
Morris Machine Works
Taber Pump Co.
Universal Motor Co.
Worthington Pump & Machinery Corp.

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Bond Co., Harold L.
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Cameron Steam Pump Wks.
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Earle Gear & Mach. Co.
Edson Mfg. Co.
McGowan Co., John H.
Parker, A. A.
Schramm and Son, Inc., Chris. D.
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Waterloo Cement Mchy. Corp.
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American Well Works, The
Cameron Steam Pump Works, A. S.
Cook, A. D.
Deming Co., The.
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Deming Co., The.
Edson Mfg. Co.
Goulds Mfg. Co.
Van Nouhuys Mch. Wks.
Waterloo Cement Mchy. Corp.

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Morris Machine Works
Parker, A. A.
Worthington Pump & Mchy. Corp.

Pumps, Elevator
Worthington Pump & Machinery Corp.

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Cook, A. D.
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Deming Co., The
Goulds Mfg. Co.
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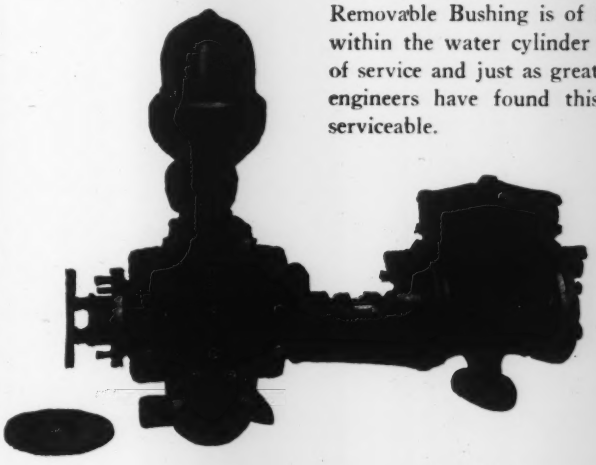

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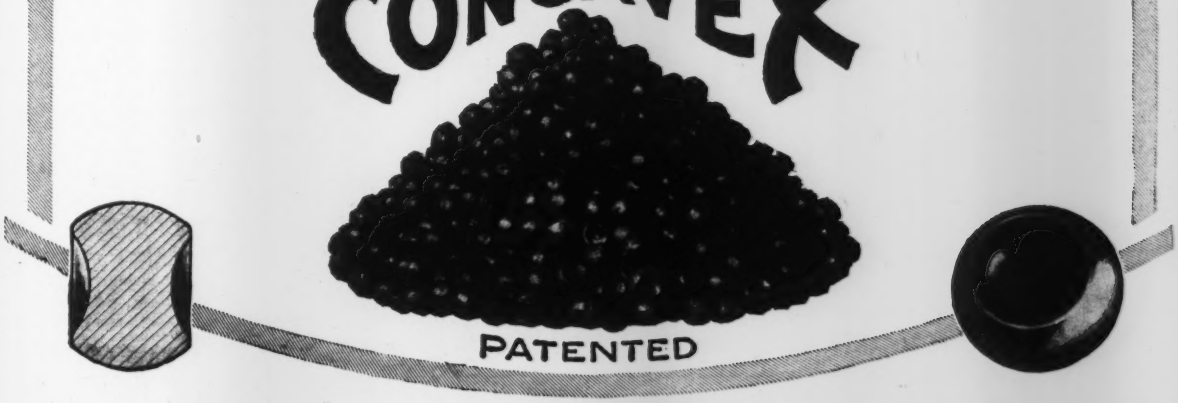

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(See Window Sash.)

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Smith Mfg Co., A. P.

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Chapman Valve Mfg. Co.
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Westinghouse Traction Brake Co.

Valves, Automatic
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Kennedy Valve Mfg. Co.
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Valves Foot
Flower Stephens Mfg. Co.

Valves, Regulating
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Wood Preservatives
Barrett Co., The
Carbolineum Wood Preserving Co.
Ohio Wood Preserving Co
Republic Creosoting Co.

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Lowell Wrench Co.
Republic Creosoting Co.

This Index is an up-to-the-minute record of NEW Equipment for contractors, engineers, etc. When you are in the market for SECOND-HAND Equipment, consult the

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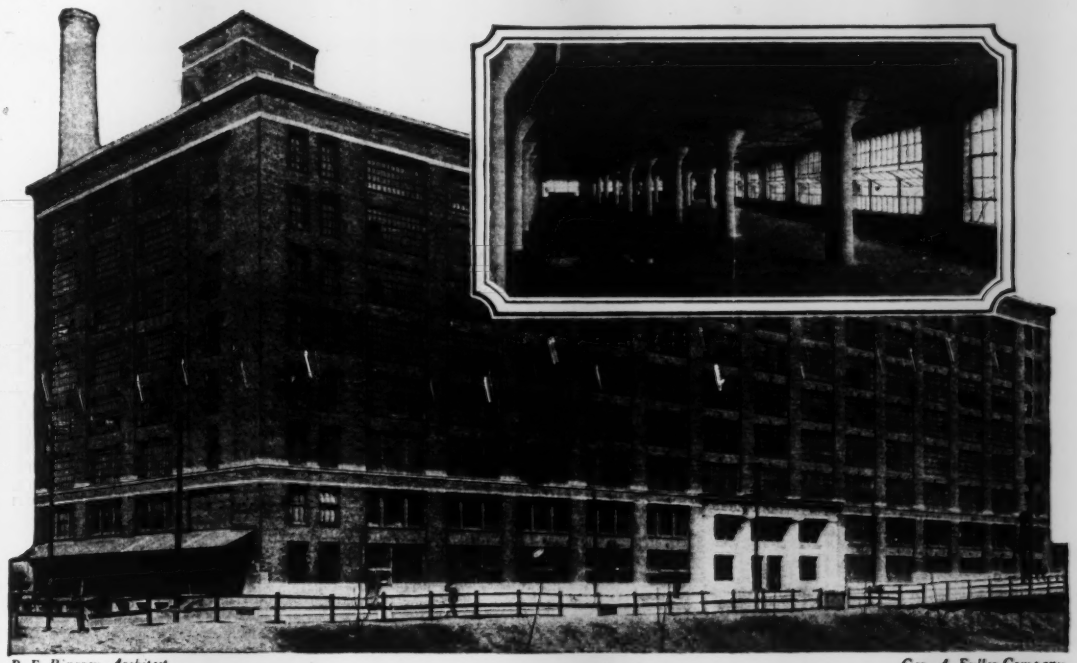
The Searchlight Section is devoted exclusively to the advertising of Employment, Equipment and Business Opportunities in the civil engineering and contracting field. It is the recognized medium of communication between owners, employers, and employees.

If you don't find what you want in this issue of the Searchlight advertise for it in the next one. You will find the response immediate and satisfactory and the cost small.



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Fenestra
SOLID STEEL WINDOWS

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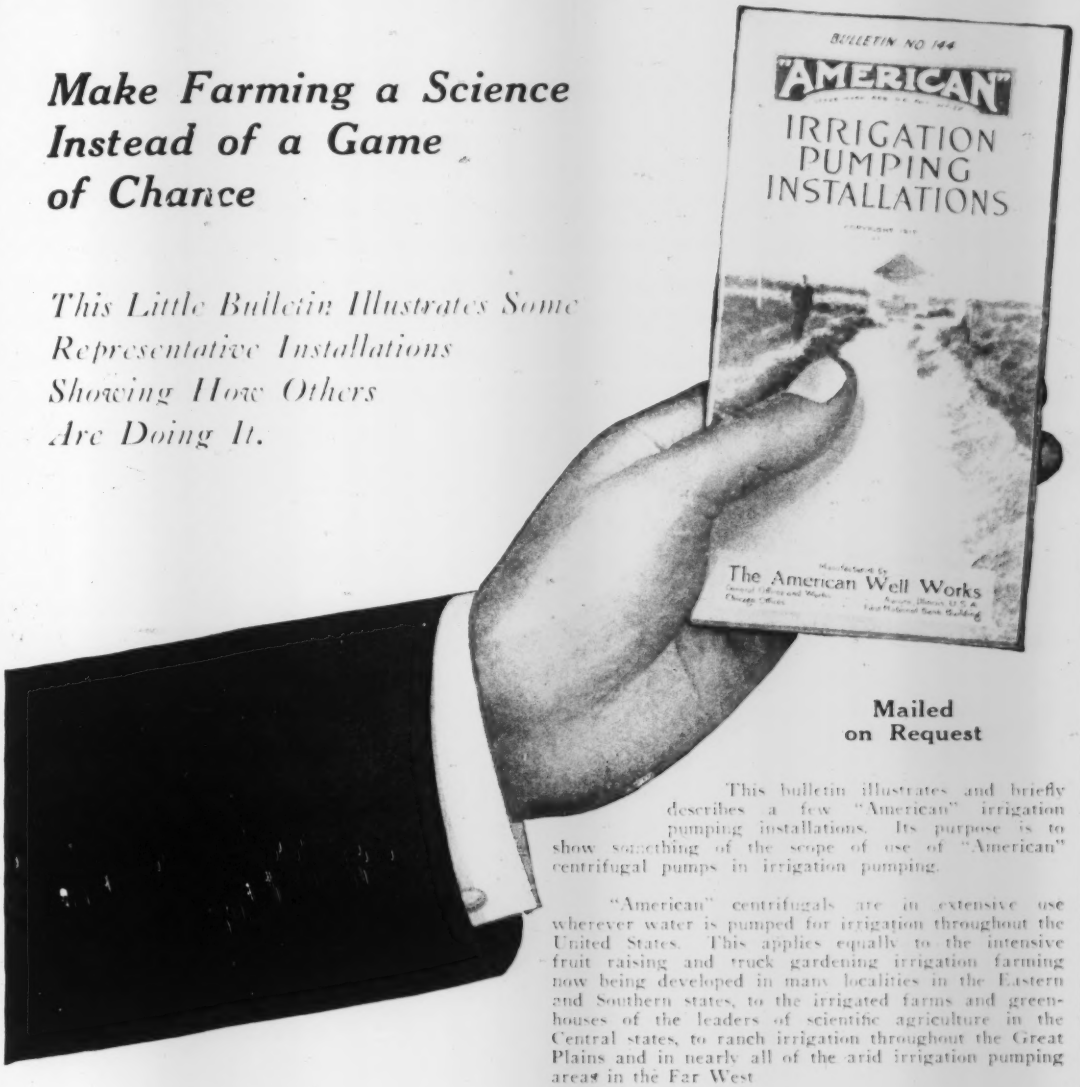
AMERICAN

Make Farming a Science Instead of a Game of Chance

This Little Bulletin Illustrates Some Representative Installations Showing How Others Are Doing It.



Mailed on Request

This bulletin illustrates and briefly describes a few "American" irrigation pumping installations. Its purpose is to show something of the scope of use of "American" centrifugal pumps in irrigation pumping.

"American" centrifugals are in extensive use wherever water is pumped for irrigation throughout the United States. This applies equally to the intensive fruit raising and truck gardening irrigation farming now being developed in many localities in the Eastern and Southern states, to the irrigated farms and greenhouses of the leaders of scientific agriculture in the Central states, to ranch irrigation throughout the Great Plains and in nearly all of the arid irrigation pumping areas in the Far West.

The wide demand for "American" centrifugals for irrigation pumping is due to the superior designs, material and workmanship characterizing their construction and to the large number of styles in which they are built, enabling pumps to be furnished that will successfully meet any irrigation pumping condition. "American" centrifugals are built in fifty regular styles, each in a full line of sizes and equipped with any power.

In addition to this, we maintain a large engineering department in which pumps to meet special or unusual conditions are constantly being designed. These pumps are carefully tested in our own hydraulic laboratory and the characteristics of each accurately plotted. The skill of our designers and our careful methods of construction enable us to place a most rigid guarantee on "American" centrifugal pumps.

The American Well Works

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Barrett's Carbosota
Grade-One Liquid
Creosote Oil

"The Unpardonable Sin"

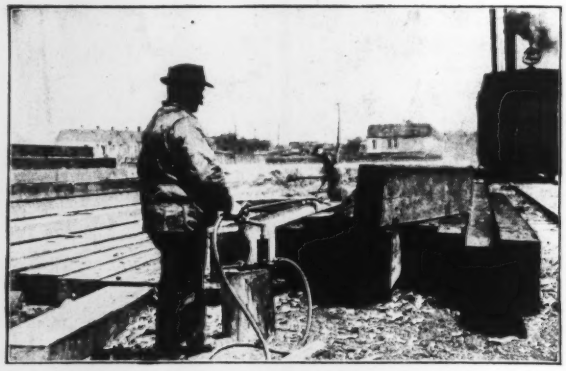
"The unpardonable sin of the business world of the future will be—*waste.*"

"Waste of *material or labor*—of time or of money—and only less heinous in degree than the sin of *commission* will be the sin of *omission.*"

These quotations are extracted from an excellent editorial of the same title appearing in the October 15th issue of "The Gulf Coast Lumberman." They are equally applicable to the *waste* that results from failure of protecting structural wood against decay.

The *"Sin of Omission"* is neglecting to become informed regarding the practice of wood preservation and the potential economy of its application.

The "Sin of Commission" is wilful disregard of the factor of durability—the attitude of "taking a chance"; the erection of timber structures where influences favorable to decay are known to exist, without employment of remedial measures.



***Spraying:** Applying Carbosota to ends, mortises, and tenons (points of contact) of caps and stringers for trestle.*

Preservation of structural wood from decay is essentially a *conservation measure,* and therefore beneficial to the *entire nation.*

Non-pressure processes—i.e. the Open Tank Process and Surface Treatments, such as brush applications, spraying or dipping are particularly adaptable to the conditions of average consumers and are *practical* as well as *efficient.*

Full information, specifications, etc., and an analysis of any particular case by experts may be obtained gratis by addressing nearest office.

The Barrett Company

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(Green wood cannot be effectively creosoted by non-pressure processes. It should be air-dry. In regions of moist, warm climate, wood of some species may start to decay before it can be air-dried. Exception should be made in such cases, and treatment modified accordingly.)

Brush-treating faying surfaces of ship timbers with Carbosota.

***The Open-Tank Process:** Simple wooden tank (lined with sheet iron) equipped with steam coils and small derrick. Upon completion of the hot treatment, both oil and timber are permitted to cool instead of being transferred to a cold tank.*